ELECTRICAL TIMES

THURSDAY

SIXPENCE

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METALCLAD SWITCHGEAR

150 MVA TO 350 MVA

3·3kV TO 11kV

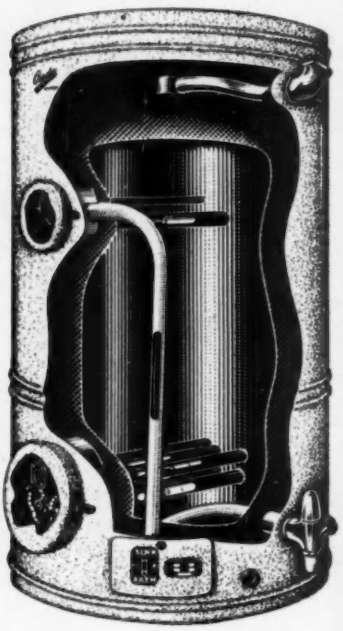
THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

THIS IS THE

Creda

DULEC double purpose electric water heater

QUICK DELIVERY

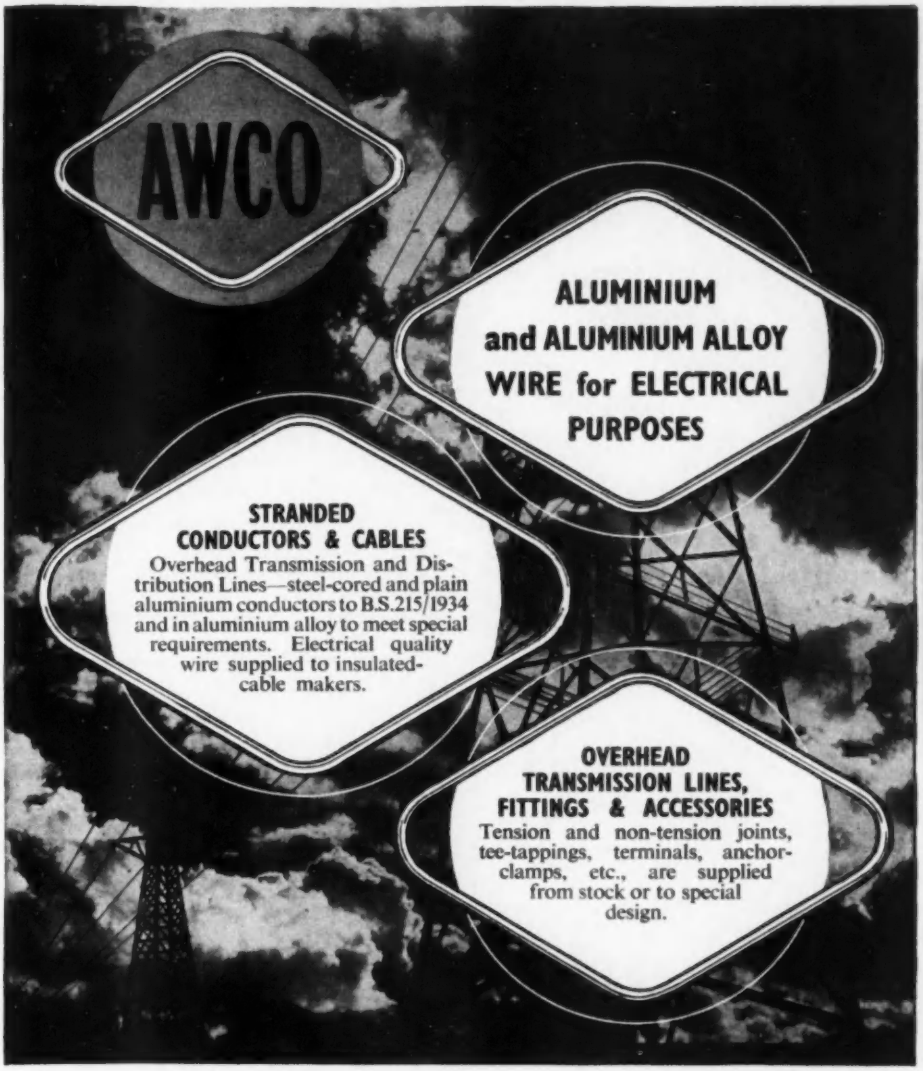


Two separate banks of immersion heaters, both thermostatically controlled, are combined in the Creda Double-Purpose electric water heater. The upper heater permanently in circuit and of low current consumption, provides sufficient hot water at any time for normal domestic use, while the lower bank for heating the tank's full capacity of 20 imperial gallons is switched into action when larger quantities are required for baths or laundering. Designed for easy installation with any plumbing system. Finished in mottle grey or white enamel—other colours are available for export. Creda for all electric water heating equipment

MADE BY THE HOUSE OF **Simplex**

Simplex Electric Company Limited
Oldbury Birmingham & Branches

A TI COMPANY


AWCO
ALUMINIUM
and ALUMINIUM ALLOY
WIRE for ELECTRICAL
PURPOSES
STRANDED
CONDUCTORS & CABLES
Overhead Transmission and Distribution Lines—steel-cored and plain aluminium conductors to B.S.215/1934 and in aluminium alloy to meet special requirements. Electrical quality wire supplied to insulated-cable makers.
OVERHEAD
TRANSMISSION LINES,
FITTINGS & ACCESSORIES
Tension and non-tension joints, tee-tappings, terminals, anchor-clamps, etc., are supplied from stock or to special design.

AWCO

Manufactured by **ALUMINIUM WIRE & CABLE CO. LTD.**

Head Office and Works: **PORT TENNANT · SWANSEA · GLAMORGAN**

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Telephone: VICTORIA 0902 *and* 0336

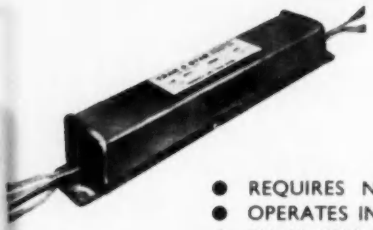
FLUORESCENT LIGHTING

THE NEW

TRAN ★ STAR

REGD. TRADE MARK

CONTROL UNIT



COMPLETELY SELF-CONTAINED WITH BUILT-IN RADIO AND POWER FACTOR CONDENSERS

- REQUIRES NO SPECIAL LAMPS OR EARTHING STRIPS
- OPERATES INSTANTANEOUSLY EVEN IN LOW TEMPERATURES
- ELIMINATES STARTERS AND STARTER CONNECTIONS
- IS COMPLETE. READY FOR FIXING

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We specialise in Light Pressings with rolled threads of all descriptions.

ROLLED THREAD LAMPHOLDERS

M.E.S. HOLDERS

Let us quote you. Highest quality work, good deliveries.

BAKER METAL STOPPER CO. LTD.

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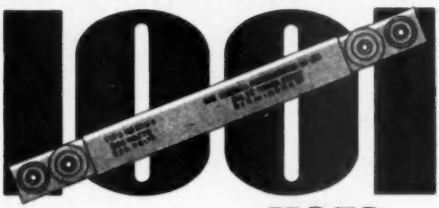
THE STEEL COVERED HEATER WITH

1001



USES

IN its variety of forms, the Cressall steel jacketed unit heater is the solution to most heating problems. Let a Cressall Technical Expert discuss heating with you before you decide. He will be happy to help.

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Registered Trade Name of

THE CRESSALL MANUFACTURING CO., LTD.

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Telephone: ASTon Cross 2666 (3 lines).

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Precision-made for Quality Performance

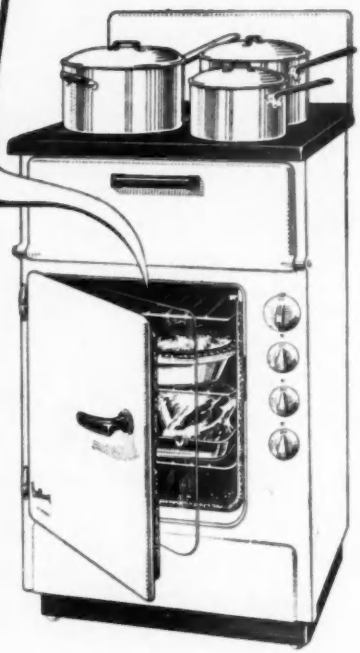
The FERRANTI FM METER

FERRANTI

PM92.

FERRANTI LTD. Hollinwood, Lancs *London Office:* Kern House, Kingsway, W.C.2.

SEE what's COOKING



The glass door is just one of the many good selling features of the latest Belling 46/47 cookers—look at these selling points.

- ★ **REALLY LARGE OVEN** with automatic temperature control.
- ★ **CLEAN LINES** inside and out, no corners or crevices to harbour grime.
- ★ **DRAWER** available, removable for cleaning floor space under cooker.
- ★ **BEAUTIFUL ACID-RESISTING FINISH** in white or cream with black vitreous enamel hob.
- ★ **LARGE HOTCUPBOARD** with clear space for plates and food.
- ★ **E.D.A. SPECIFICATION** throughout makes servicing easy.

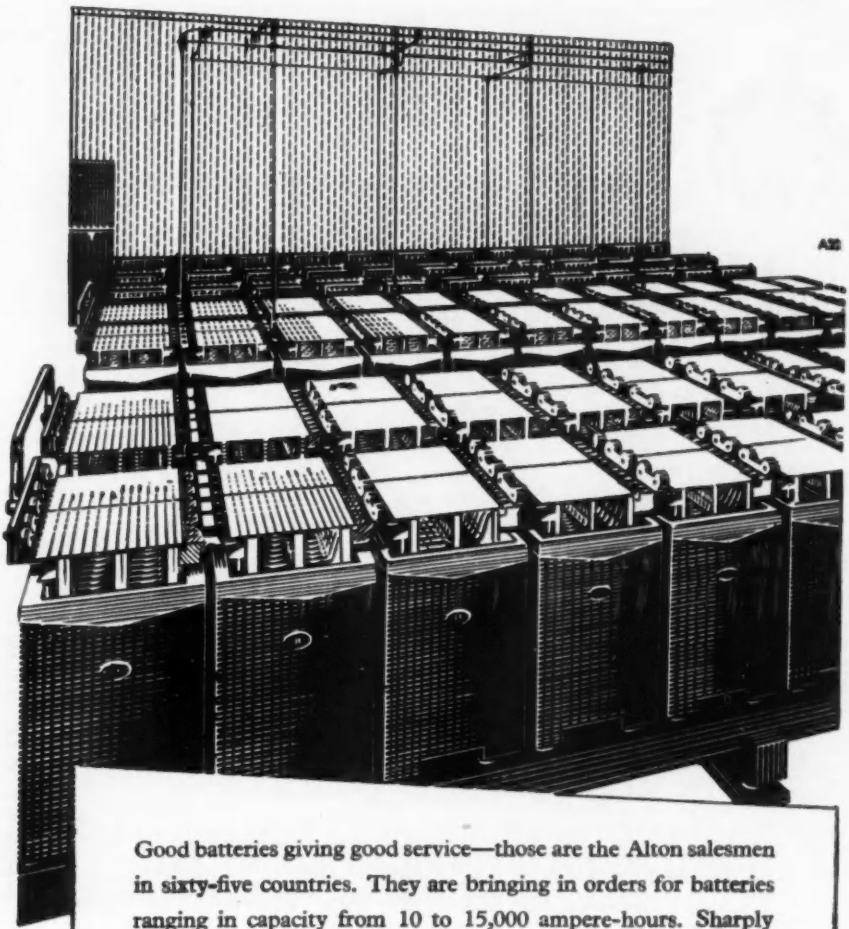
47AB, 8″ and 6¼″ boiling plates, grill boiler, glass door . . .	£28 . 17 . 6
47A without glass door	£26 . 17 . 6
46AB, 8″ boiling plate, grill boiler, glass door	£26 . 5 . 0
46A without glass door	£24 . 5 . 0

Drawer 20/-. Cream finish 10/-. Simmerstat 15/6. Radiant Plate 23/6

You can't beat a 'Belling'

BELLING & CO., LTD. · BRIDGE WORKS · ENFIELD · MIDDX.

CBC 355



Good batteries giving good service—those are the Alton salesmen in sixty-five countries. They are bringing in orders for batteries ranging in capacity from 10 to 15,000 ampere-hours. Sharply increasing orders: but Alton, long experienced in export, is organised to meet them—with good batteries and firm delivery dates.

ALTON

Alton can also supply renewal plates for all makes of battery, British and Continental

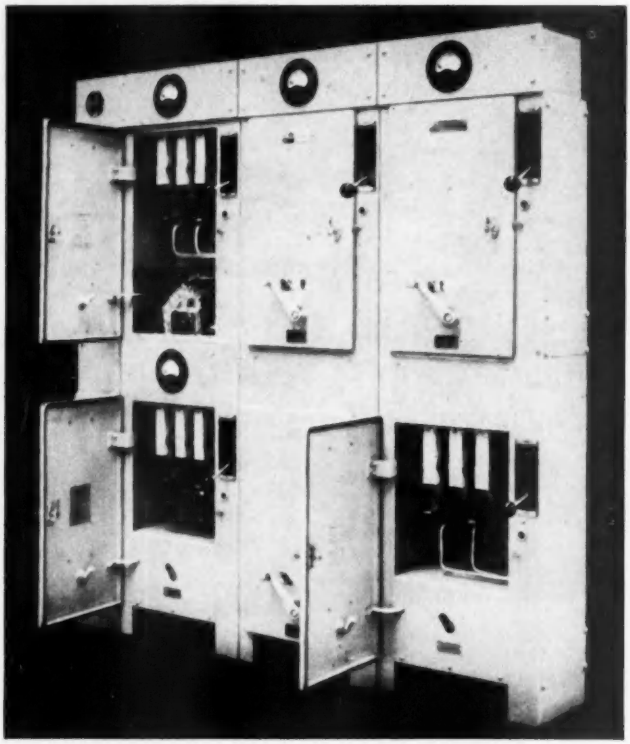
BATTERIES OF MERIT

THE ALTON BATTERY CO. LTD

Alton, Hants. Telephone: Alton 2267 and 2268. Grams: Battery, Alton

BELMOS

POWER DISTRIBUTION SWITCHBOARDS



UP TO 200 AMPS 650 VOLTS

FEATURES:

- DOUBLE TIER—SPACE SAVING
- UNIT CONSTRUCTION—READILY EXTENDED
- ISOLATOR INTERLOCKED WITH DOOR
- WITH OR WITHOUT HRC BACK-UP FUSES
- COMPONENT ITEMS OF PROVED ABILITY

THE BELMOS COMPANY LTD.

BELLSHILL • LANARKSHIRE

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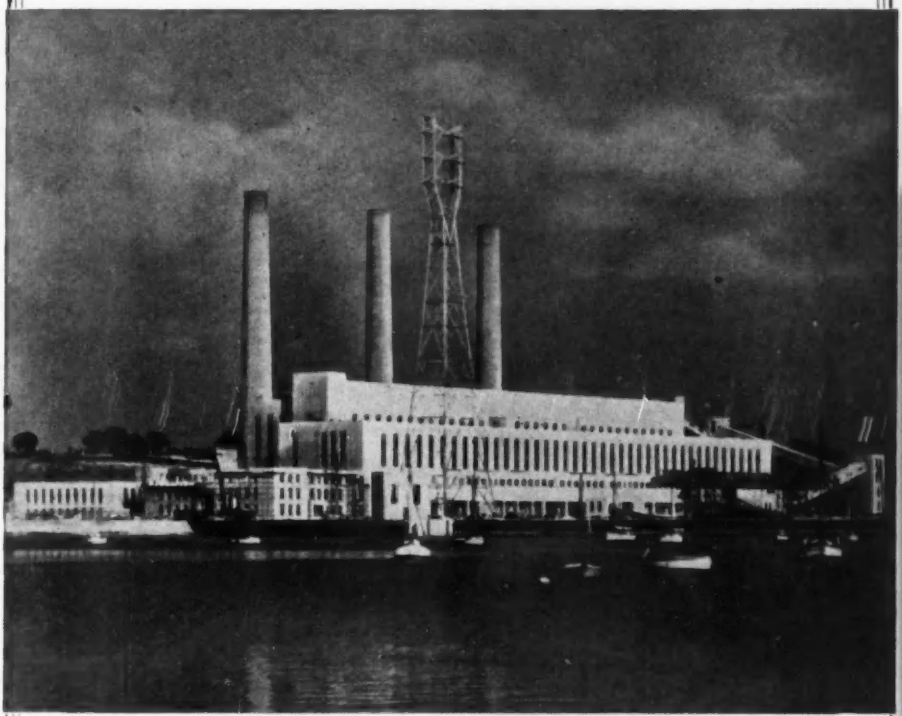
WAKEFIELD OIL FOR INDUSTRY



All the turbines and ancillary equipment of the British Electricity Authority's new Cliff Quay Power Station are lubricated with Wakefield Industrial Oils.

Cliff Quay Power Station is lubricated with

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WALTER F. HIGGS, M.I.E.E., LTD.
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A GUARANTEE FOR EVER

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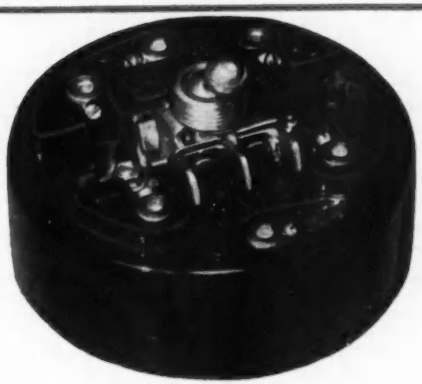

DOUBLE-POLE CHANGE-OVER SWITCH, one of the thousand and one switches made by Lundberg. First and foremost, switchgear for fishermen has to be robust and efficient.

This Lundberg switch conforms in every detail to the requirements for rugged duty and is used extensively for radar and equipment control on sea-going craft

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A TI COMPANY

Stocked and distributed by all branches of SIMPLEX ELECTRIC CO LTD

Ducter Ohmmeter is British Railway veteran

Using the Ducter Ohmmeter to test the resistance drop on an armature from a motor generator belonging to main line stock (Waterloo to Portsmouth type).

Thirty years' service of regular armature testing.

A Ducter Ohmmeter has been in regular use at the Durnsford Road Electric Carriage Repair Shop, Wimbledon, of British Railways (Southern Region) since February 1917. It is still in use for routine tests on traction motor armatures of both suburban and main line stock.

Southern Region Electric trains are withdrawn from service every 12 to 18 months after running a distance of 100,000 miles in the case of suburban stock and 80,000 miles for main line stock.

After entering the Repair Shop, the bogies and motors are stripped down, thoroughly overhauled, re-assembled and tested before being returned to service.

Ducter Ohmmeter readings are taken of the resistance drop in the traction motor armatures, and if the readings are below a prescribed limit no further examination is considered necessary, but should they show wide diversions from the standard, a detailed examination is undertaken.

For details of the Ducter Ohmmeter, send for Evershed Publication J.237.

EVERSHED & COAL MINE SAFETY

The Evershed Safety Ohmmeter is the ideal instrument for testing the continuity and resistance of shot-firing circuits, its construction being such that even on dead short circuit, the testing current cannot exceed 12 milliamperes.

The instrument is incapable of causing an explosion of Methane or Pentane and carries intrinsic safety certificates both from the Ministry of Fuel and Power and from H.M. Inspector of Factories.

The Evershed Safety Ohmmeter is a compact instrument housed in a black plastic case and weighs only 3 lbs. *Full details in Publications* J215.

MEGGER TESTER RIDES AGAIN!

This is the true story of a Megger Insulation Tester that liked it rough. On night shift at a colliery, it was dislodged by falling coal. Then it travelled. Its journey logs as follows:—

50 yards of coal face conveyor belt.
¼ mile of 'Gate Conveyor Belt.'
1½ miles of uneven haulage road (while buried under ½ ton of coal).
Wound up shaft.
¾ mile rough surface. 15 foot drop.

The Megger Tester then returned to the 'Electric Shop' unharmed. Evershed do not record whether it apologised for being late.

EVERSHED

PROCESS CONTROLLERS · REMOTE CONTROLLERS
INDICATORS & RECORDERS · **MEGGER** TESTERS
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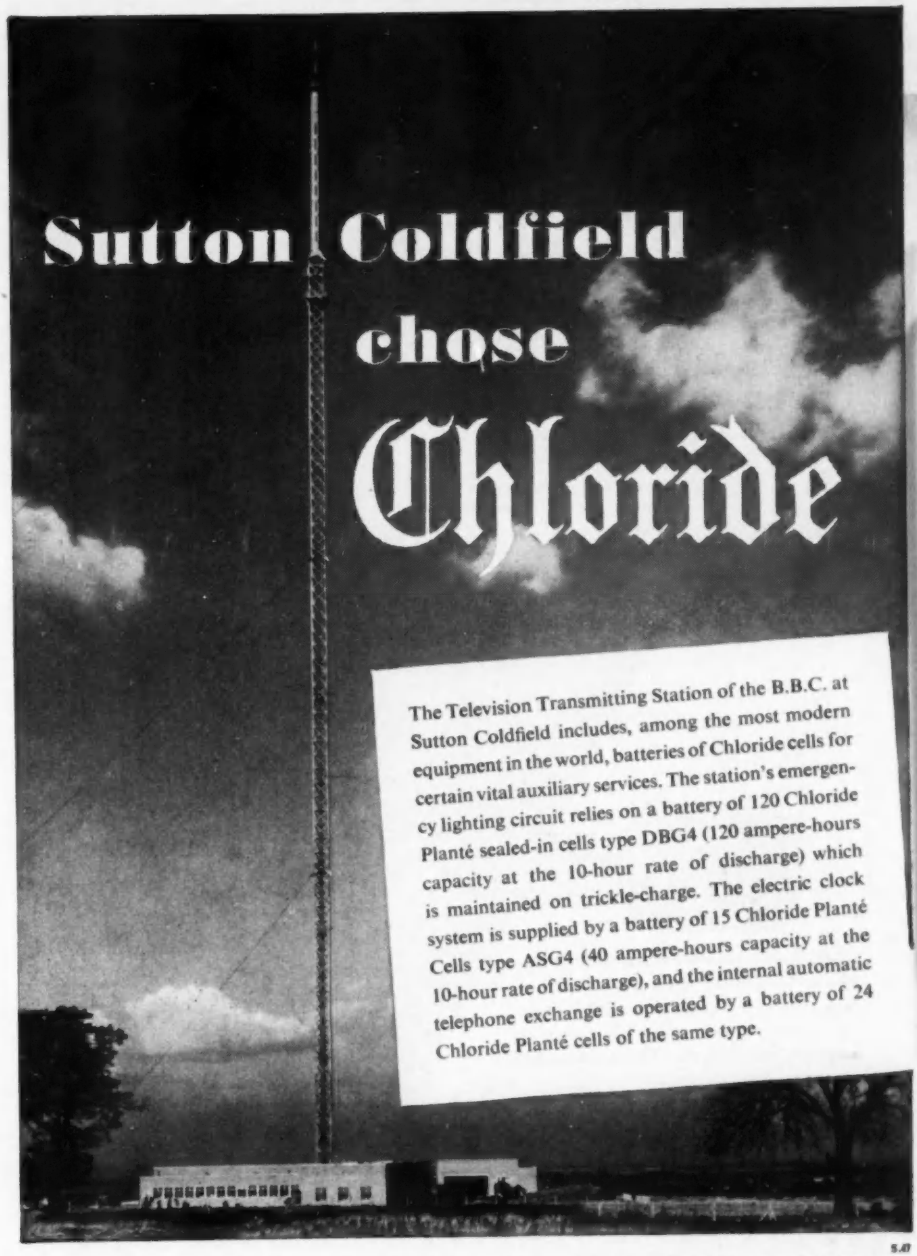


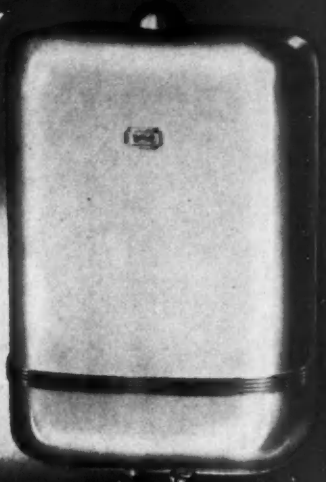
The Television Transmitting Station of the B.B.C. at Sutton Coldfield includes, among the most modern equipment in the world, batteries of Chloride cells for certain vital auxiliary services. The station's emergency lighting circuit relies on a battery of 120 Chloride Planté sealed-in cells type DBG4 (120 ampere-hours capacity at the 10-hour rate of discharge) which is maintained on trickle-charge. The electric clock system is supplied by a battery of 15 Chloride Planté Cells type ASG4 (40 ampere-hours capacity at the 10-hour rate of discharge), and the internal automatic telephone exchange is operated by a battery of 24 Chloride Planté cells of the same type.

5.41

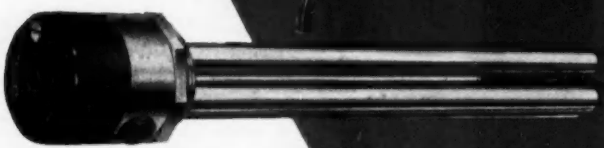
A PRODUCT OF CHLORIDE BATTERIES LIMITED 77 KING STREET, MANCHESTER 3

Suiting the Modern Scheme

New Look



★ Flat backed and flush fitting—in Pastel Blue, White, Cream or Green, with chromium plated fittings—here is a heater abreast of the best in modern kitchen and bathroom design.



★ Latest addition to Berry's Immersion Heater range is this new Withdrawable Element model. Cap and collar are easily removable, allowing free access without disturbing electrical connections

BERRY'S

NEW YORK · BIRMINGHAM
MANCHESTER · NEWCASTLE
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BERRY'S ELECTRIC LTD.,
TOUCHBUTTON HOUSE,
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PETROCHEMICALS LIMITED

introduce

'CATAREX' PITCH

✲ FREE CARBON CONTENT LESS THAN 5%

✲ TOTAL SULPHUR LESS THAN 0·2%

✲ ASH LESS THAN 0·1%

Physical Properties of Typical Grades:

	GRADE 40°	GRADE 60°	GRADE 80°
✲ SPECIFIC GRAVITY	1.15	1.18	1.20
✲ PENETRATION AT 77°F. (100 grams/5 seconds)	190	10	nil
✲ PENETRATION AT 115°F. (100 grams/5 seconds)	>350	120	15
✲ DUCTILITY AT 25°C. (5 cms/minute)	>100 cm.	1.5 cm.	nil
✲ FRAAS BREAKING POINT	1°C.	20°C.	>30°C.

The average melting point is from 30°C. to 100°C. by 10° steps.

'CATAREX' PITCH, produced by the Catarole cracking process, is of consistently high quality. It is entirely aromatic and combines the properties of coal tar pitch and petroleum-derived bitumens.

'Catarex' Pitch is available in grades from 40° to 100°. Specific enquiries for this product are welcomed.

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170 Piccadilly, London, W.1 Telephone: MAYfair 6618

Telegrams: Petricals, Piccy, London

MANCHESTER SALES OFFICE

Partington Industrial Estate, Urmston, Manchester

Telephone: Irlam 2601 Telegrams: Petricals, Manchester

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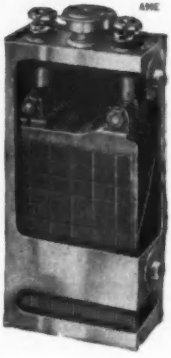
Like an outboard motor, the Alklum Steel-Alkaline Battery packs plenty of power into a small space. Compact and sturdily built to withstand prolonged hard use, quick to recuperate after heavy discharge, the Alklum Battery gives maximum service for minimum maintenance costs.



ALKLUM

STEEL-ALKALINE BATTERY

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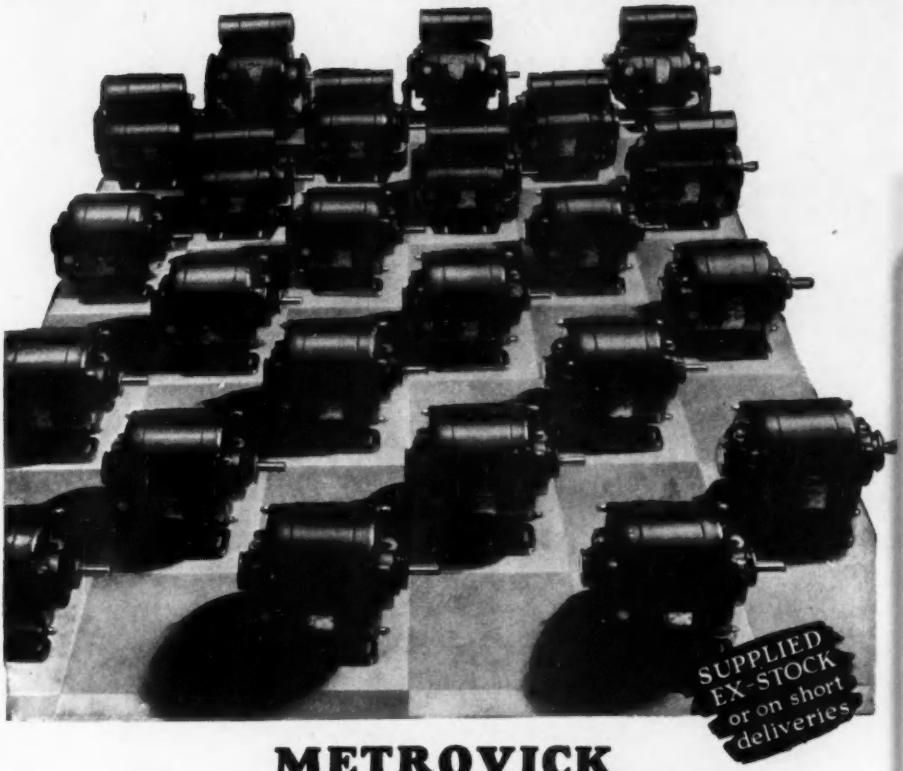
for immediate employment



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FRACTIONAL hp. MOTORS

Britain's economic position demands the most efficient use of every unit of power—even that from the smallest fractional hp. motor.
To gain maximum efficiency from the electric power used in your plant you you cannot do better than specify motors by Metrovick. Made in sizes from 1/50th to 25,000 hp.—and upwards.

METROPOLITAN-VICKERS ELECTRICAL CO. LTD.

TRAFFORD PARK, MANCHESTER 17

JQ/901

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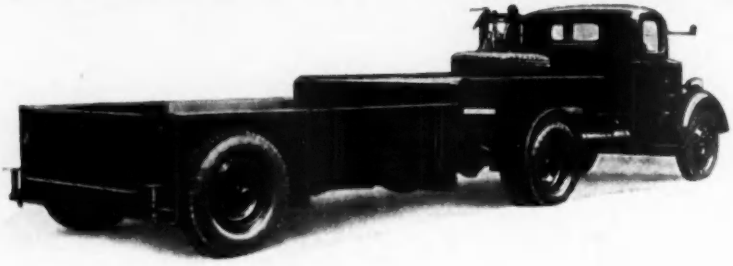
A new range of EDISON SCREW Lampholders

Write for details to:

NETTLE ACCESSORIES LTD.

HARPER ROAD WYTHENSHAWE MANCHESTER



The above illustrates a 6-ton Drop Frame Semi-trailer for the Transport of Cable Drums and Transformers, etc., and is one of a large fleet recently delivered. The lower deck has a space of 10ft. 0in. by 5ft. 3in., and is steel lined with ¼in. plates and fitted with detachable 1ft. 6in. sides. The top deck is fitted with a hand operated winch and necessary cable, and as well as the taildoor at the rear of the body, special loading skids are also provided.

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5019 A

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This catalogue describes those standard types of rubber insulated cables and flexibles in general use. If you have not yet received a copy write to-day for Publication No. 269W.

B.I. Callender's

RUBBER CABLES AND FLEXIBLES

BRITISH INSULATED CALLENDER'S CABLES LIMITED
NORFOLK HOUSE, NORFOLK STREET, LONDON, W.C.2

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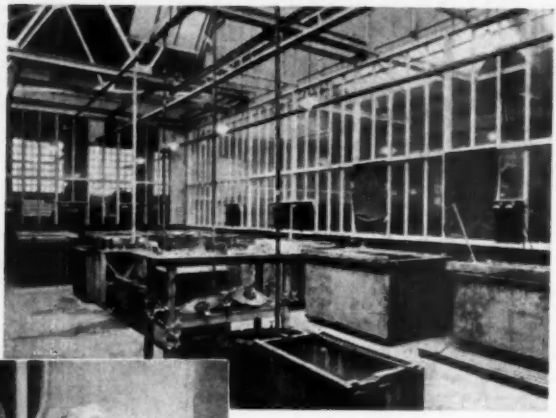
Birmingham



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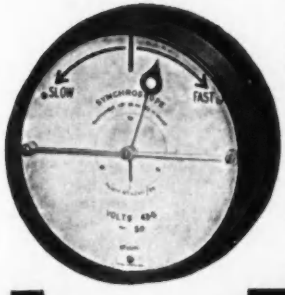
INSTRUMENTS

B.S. FIRST GRADE

N.C.S. PRODUCTS include all types of Measuring Instruments, Indicating or Recording, in various patterns and sizes, Switchboard or Portable. Also Protective Relays, Frequency Meters, Vectormeters, Bijou Circuit Breakers, etc., and Flameproof Instruments and Relays.

1. LONG SCALE INDUCTION WATTMETERS for A.C. For use on Single Phase and Polyphase Balanced or Unbalanced load systems with scales marked in Watts, Kilowatts or Megawatts.

2. AMMETERS OR VOLTMETERS for measurements of D.C. and A.C. Round type Hyper-scale Switchboard Instruments, Moving Coil and Moving Iron pattern 1½ in. to 20 in. dia. *Also* Long scale (300°) Induction pattern from 3½ in. to 20 in. dia.



3. ROTARY SYNCHROSCOPES show whether incoming machine is running above or below synchronous speed, the phase relation of the incomer with respect to the bus-bars, and the exact moment of synchronism. Round Switchboard pattern: 8 in. to 20 in. dia. dial.

The TRADE MARK Guarantees efficiency

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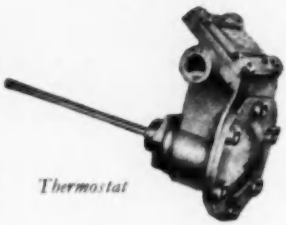
"Duncan Low" **ELECTRIC HEATERS**

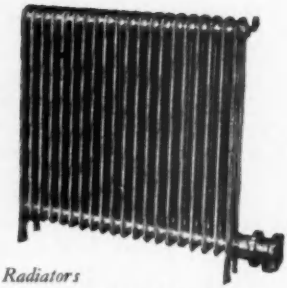
FLAME FLP PROOF

Immersion Heater

Certified by Mines Dept. Buxton



Thermostat



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1 *kw*, 1.5 *kw*, 2 *kw* & 3 *kw*

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Compensation for parallel operation and or over compounding readily provided.

of generators (and motors) of ALL SIZES (working singly or in parallel) under all conditions and in all circumstances; it is reliable even under "short circuit" conditions—thanks to simple and efficient anti-hunting features. No vibrating contacts—therefore no rating limitations. Control mechanism works under pressure oil, eliminating friction and wear. Automatically operated field rheostat is immediately available for hand regulation if required to meet special conditions.

Full data gladly supplied upon request. May we investigate your special problems?

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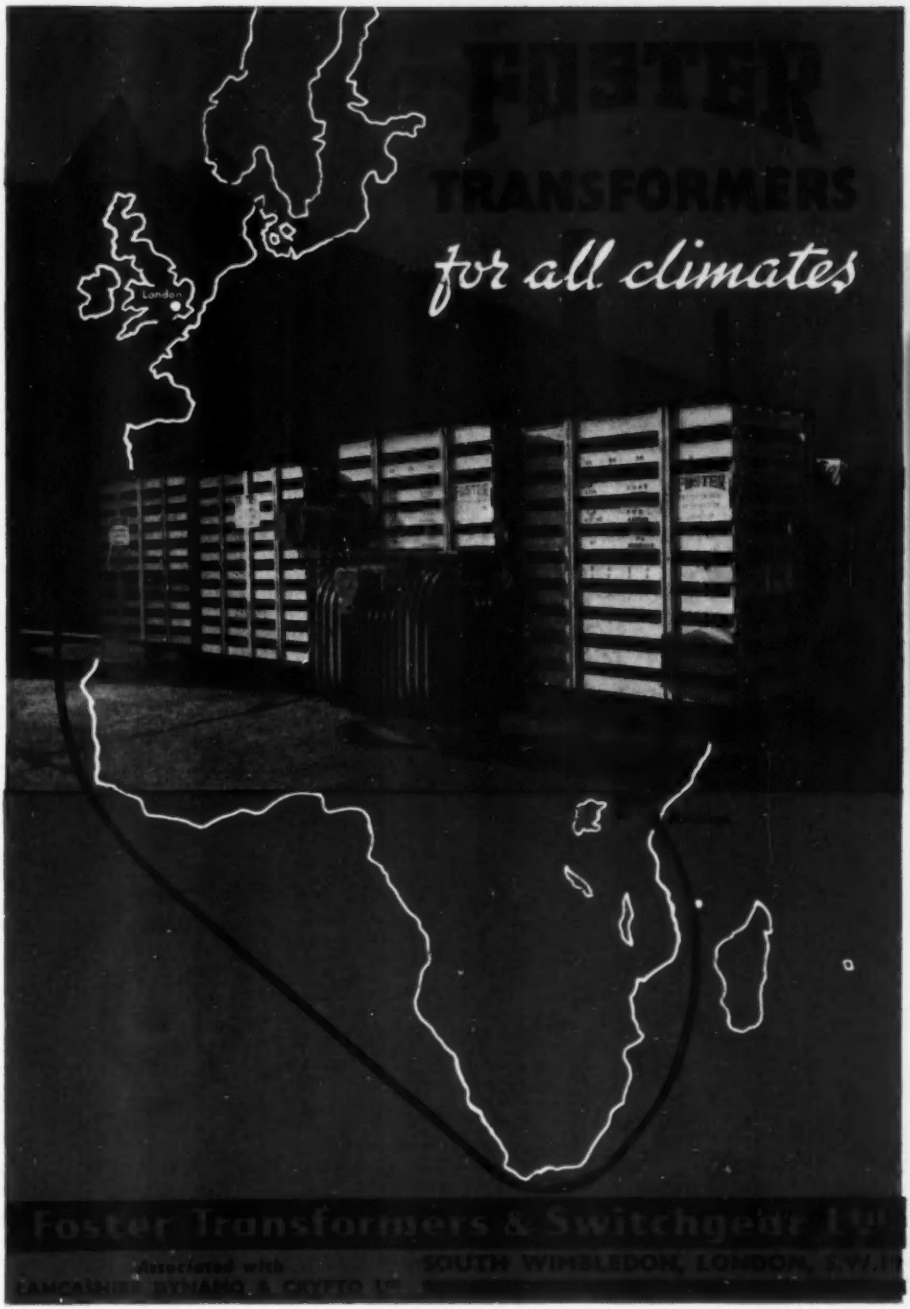
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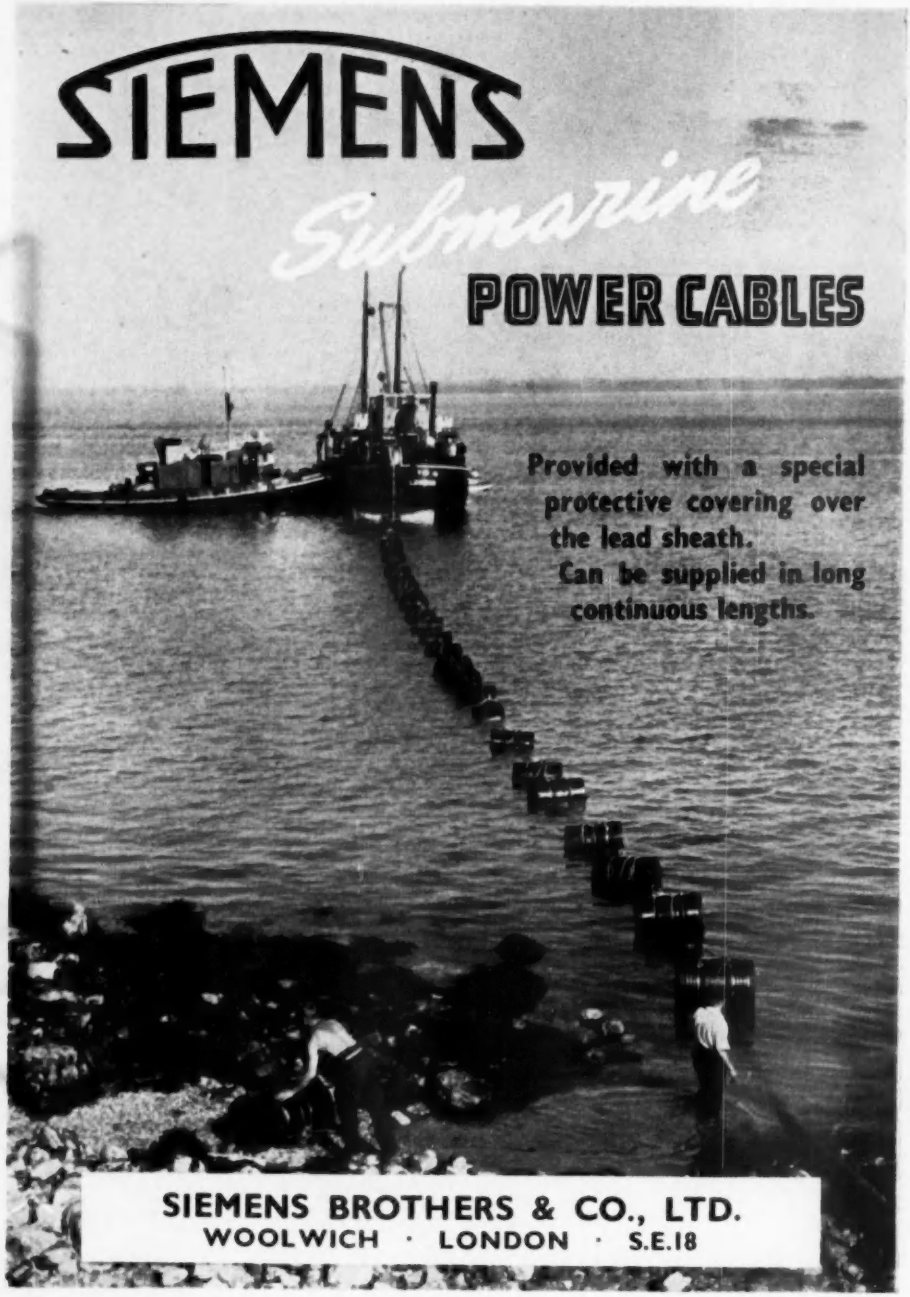
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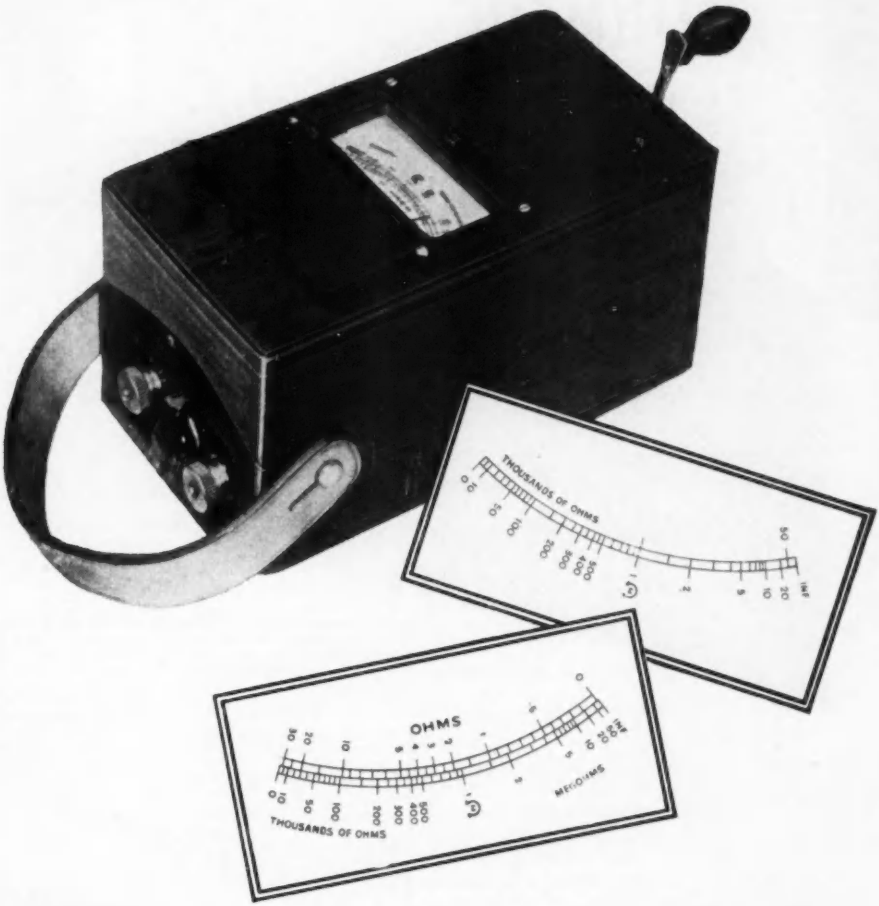

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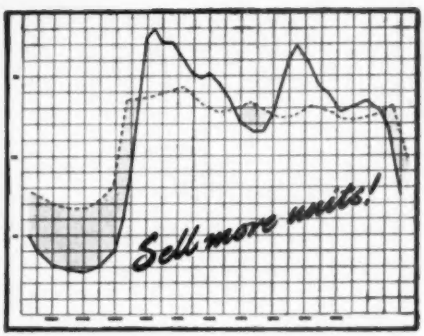

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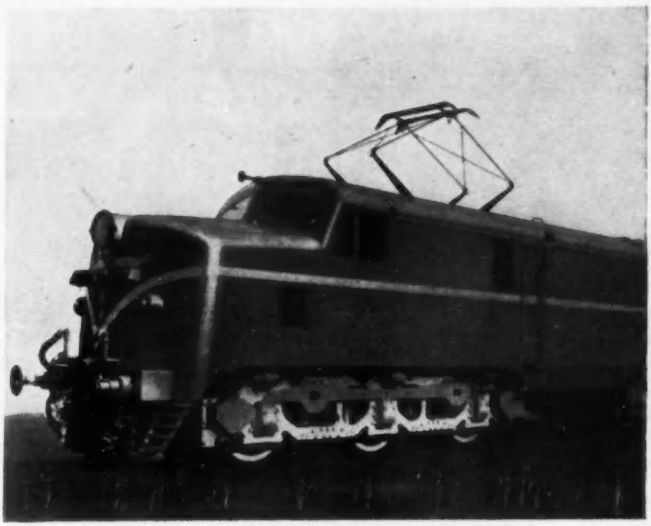

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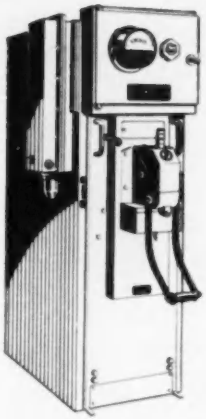

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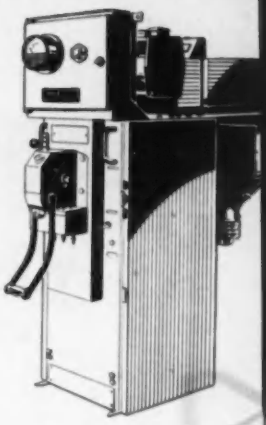

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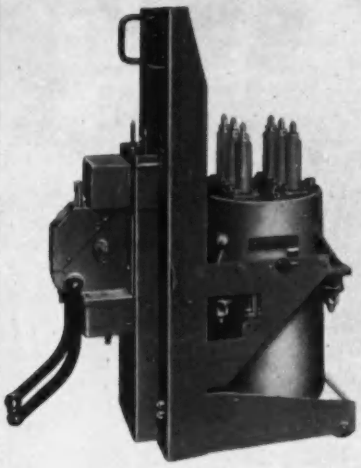

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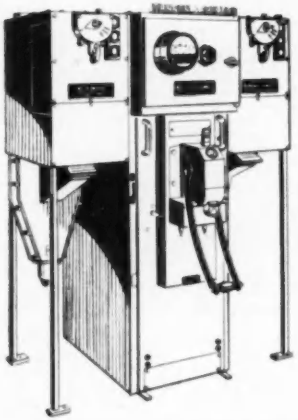

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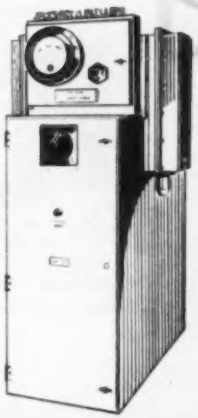

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This instrument has been specially designed for the electrical industry.

Current: A.C. and D.C. (0 to 12 amps).
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Size: 8 ins. x 7¼ ins. x 4½ ins. Weight: 6½ lbs. (including leads)
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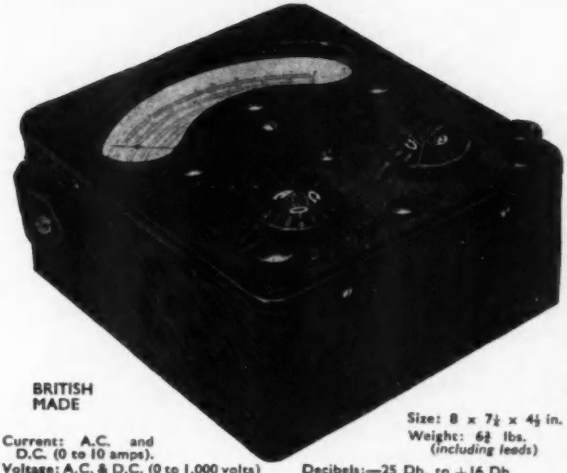

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The Model 7 Universal AVOMETER

This Instrument provides 50 ranges of readings on a 5-in. hand-calibrated scale. Range selection is by means of two rotary switches, for A.C. and D.C. respectively. A press-button provides an additional range for each value of current and voltage shown on the switch knobs. Current consumption is 1 mA or 2 mA at full-scale deflection, according to whether the press-button is used or not. The total resistance of the meter is 500,000 ohms. An automatic cut-out provides protection against damage through severe overload.

Size: 8 x 7½ x 4½ in.
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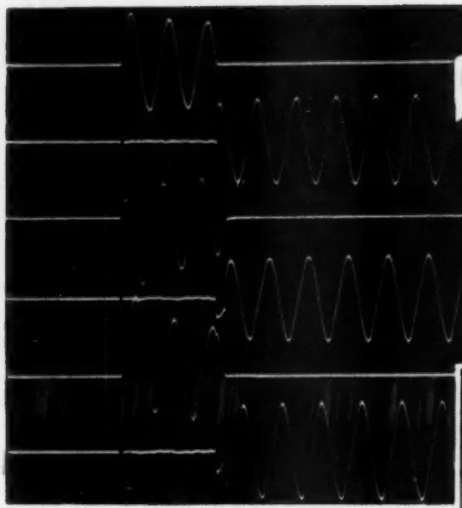

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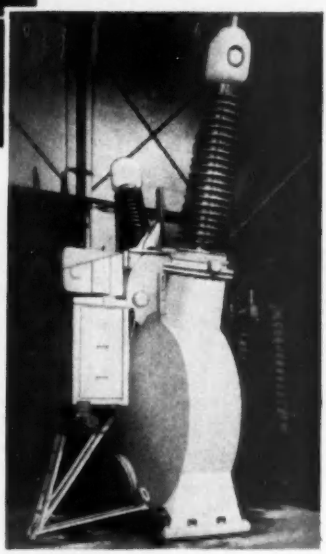

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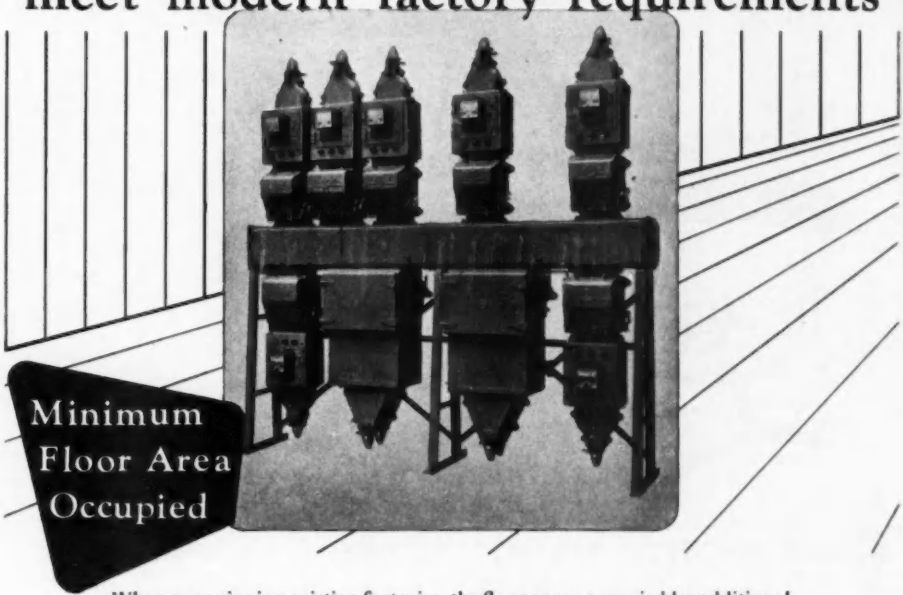

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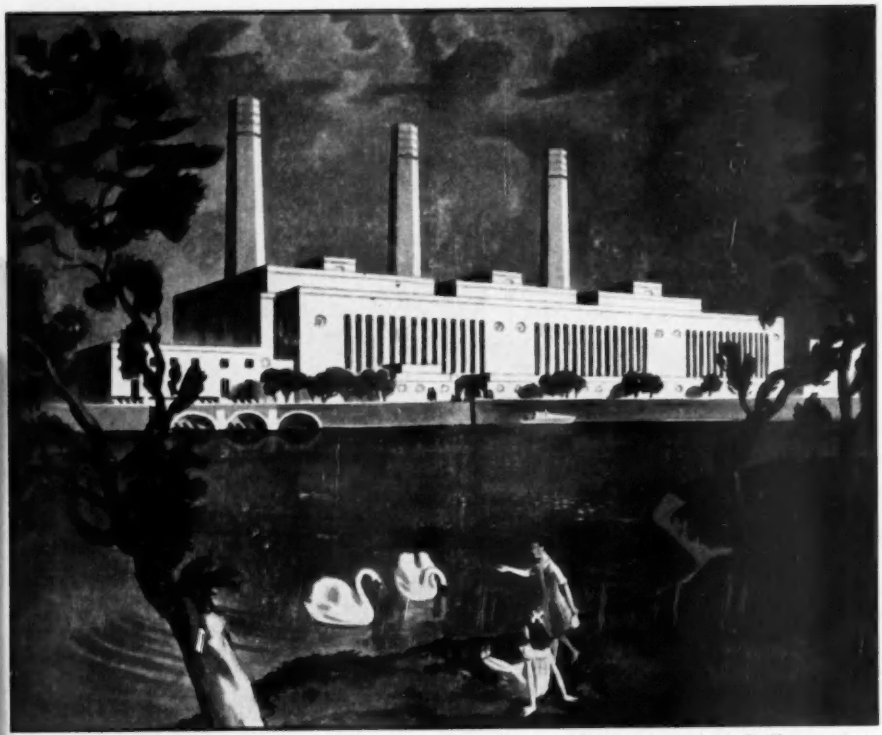

From a painting by A R. Thomson, R.A.

Another New Power Station

ON THE WEST BANK of the River Trent, near Newark, stands one of Britain's finest power stations. Staythorpe — the fourth great post-war power plant to be brought into operation by British Electricity — is an engineering triumph of which the nation can be proud.

A great achievement

The entire 150-acre site of this power plant was raised 9 feet to bring it above flood level. 1,600 people have laboured, building roads and railways. Thousands of tons of steel and concrete and millions of bricks have been used. The plant and equipment were made in workshops all over Britain. Already one third of the plant is in operation and, when completed, the total output of Staythorpe will be 360,000 kilowatts. An unusual feature of the station is the use of "Spreader" type stokers — the first large-scale installation in this country. The coal is spread by eight rotary feeders.

What it means to you

Staythorpe is only one of 38 power stations being built by British Electricity. In addition, 43 existing stations are being extended to give increased output. It is part of the plan to provide Britain's factories and workshops, farms and homes with the abundant power they urgently need.

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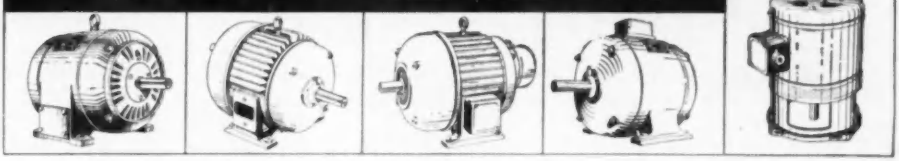

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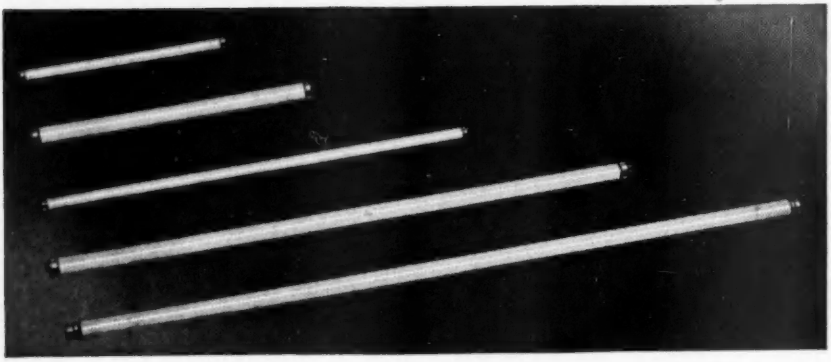

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Vol. 118 No. 3061 THURSDAY, 6 JULY, 1950

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AGECROFT POWER STATION 3
TRANSMISSION LINE CHARTS *by J. R. Mortlock, Ph.D., B.Sc.(Eng.), M.I.E.E., M.A.I.E.E.* 4
OUR READERS' VIEWS 8
C.I.G.R.E. 9
PROBLEMS AND PRACTICE IN ENGINEERING 13
SCHOOL LIGHTING ECONOMICS *by F. J. Farmer* 15
PITHEAD GENERATION 19
OVERSEAS NEWS 20
PERSONALITIES IN THE INDUSTRY 22
I.E.E. PREMIUM AWARDS 24
ELECTRICAL INTEREST AT THE CIVIL ENGINEERS' CONVERSAZIONE 24
POWER FOR THE PRINTING PRESS 25
COAL IN 1949 26
THE BUYER'S COLUMN 27
THE WEEK IN NEWS 29
Questions in Parliament 34
Cases in Court 35
Electric Supply News 36
Company Activities 37
COMMERCIAL INFORMATION 38
CLASSIFIED ADVERTISEMENTS *43*
INDEX TO ADVERTISERS *50*

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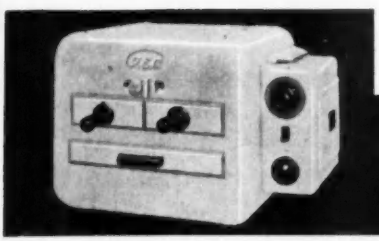

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Editorial

CONVENTION TIME

WITH last week's opening of the C.I.G.R.E. Conference in a Paris demonstrating to delegates what a heat wave really should be, the conference season may be said to have reached its height, indeed, surely a record height. Apart from individual Association conferences, the national B.E.P.C. finished only six days prior to the C.I.G.R.E., and this is to be followed immediately by the World Power Conference in London; a total of 20 conference days in four weeks. We cannot help feeling there will be several cases of mental indigestion, particularly amongst delegates to both the international conferences. These provide a total of some 302 papers to be discussed in 13 conference days. Even with the adoption of concurrent sessions, this is no mean achievement.

PAYING FOR NEW MAINS

WE are pleased to see that official recognition has now been given to the economic conditions under which electricity boards may be asked to supply new housing estates. Not always is the prospective revenue sufficient to justify the laying of new mains and now that some local authorities are tending to favour gas cooking solely because of the lower capital cost, this difficulty may arise to an increasing extent in the future. There have been several cases recently of Area Boards asking for a capital contribution in such special cases and we learn that this question has been discussed at Ministerial level. As a result of these discussions, the Ministry of Health has issued a memorandum to local authorities stating that they should admit such requests for contributions where they can be justified economically; but, be it noted, in respect of new mains only and not services. This official guidance should facilitate the commercial officer's task of negotiation, but it should also bring home to local authorities that if they put up a bar to electric cooking to save capital expenditure, they will be little in pocket thereby.

MONEY IN METERS

NEARLY 50 years ago, Mr. Edmundson had 19s. stolen from his gas meter and this is likely to result in a good deal of trouble in the near future. The question of who is legally in possession of money in prepayment meters is one which periodically arises, and in recent years magistrates have shown a tendency to take the view that the householder is in possession. It was on this reasoning that, as we recently reported, the Eastbourne magistrates found a wife not guilty of stealing money from the meter, since her husband was in possession and would be accountable to the undertakers. We now learn that an appeal is likely by way of case stated. Certainly, in Mr. Edmundson's case it was held that the gas undertaking was in possession of the money in the prepayment meter and this appears to be the only reported King's Bench case on this point. Unquestionably, the issue requires restatement but supply authorities will hardly welcome the ruling to this effect. In such circumstances, should the money be missing, the onus will be on them to show whether it was stolen by the householder himself, or by some third party, and only in the former case will redress be likely.

POWER AT THE PIT

COMPETITION as a spur to engineering development has worked well in Germany, judging by the report recently issued of the trip made by a National Coal Board team to Ruhr pithead power plants. There the intensive attack on the low-grade coal problem has resulted in the building of moderately large power stations to use the by-products of central washery plants, and in the application of advanced steam conditions to aid economic working. No doubt,

conditions are dissimilar from those in this country, but the evident German success in this direction should encourage those who see pithead generation as the best outlet for very low-grade coals and slurries. N.C.B.'s plan to increase coal preparation plant should, when carried out, strengthen the case still further, but there is a note of warning in the report when it comes to combined washery-power plant operation, for success is regarded as conditional on colliery operation of the overall scheme. However, it must be remembered that the report was prepared by Coal Board officials, who had not the problems of large-scale system operation in mind: some compromise may well be effected.

D.C.—A.C.—D.C.?

ONE OF the major problems confronting the pioneers in the application of a.c. power has been that of providing a variable speed drive. Apart from two-speed operation by pole-changing or cascade operation, the induction motor does not lend itself to variable speed operation, save to a certain extent by rotor resistance or slip regulator control. D.C. operation, either by straight conversion, or Ward-Leonard control was essential until the advent of the polyphase commutator machine, which was frequently more attractive than d.c. conversion schemes. With the development of electronic control in the last few years, the d.c. motor returns rejuvenated, to challenge the commutator motor once more. The comparison of rival methods of variable speed motor operation is a difficult task—it is impossible to lay down hard and fast rules for the "best" method—all have their advantages and limitations. Some interesting light is thrown on the subject by the report of comparative demonstrations recently given by Reyrolle Ltd. on printing press drives by both d.c. and a.c. machines, which are briefly summarised elsewhere. Few applications present such exacting requirements as the drive of printing machinery, where accurate "inching" and "creeping" are coupled with a necessity for close regulation at high speeds. The results show that though both d.c. and a.c. schemes can give satisfactory results, any scheme may be the "best" for a particular set of circumstances.

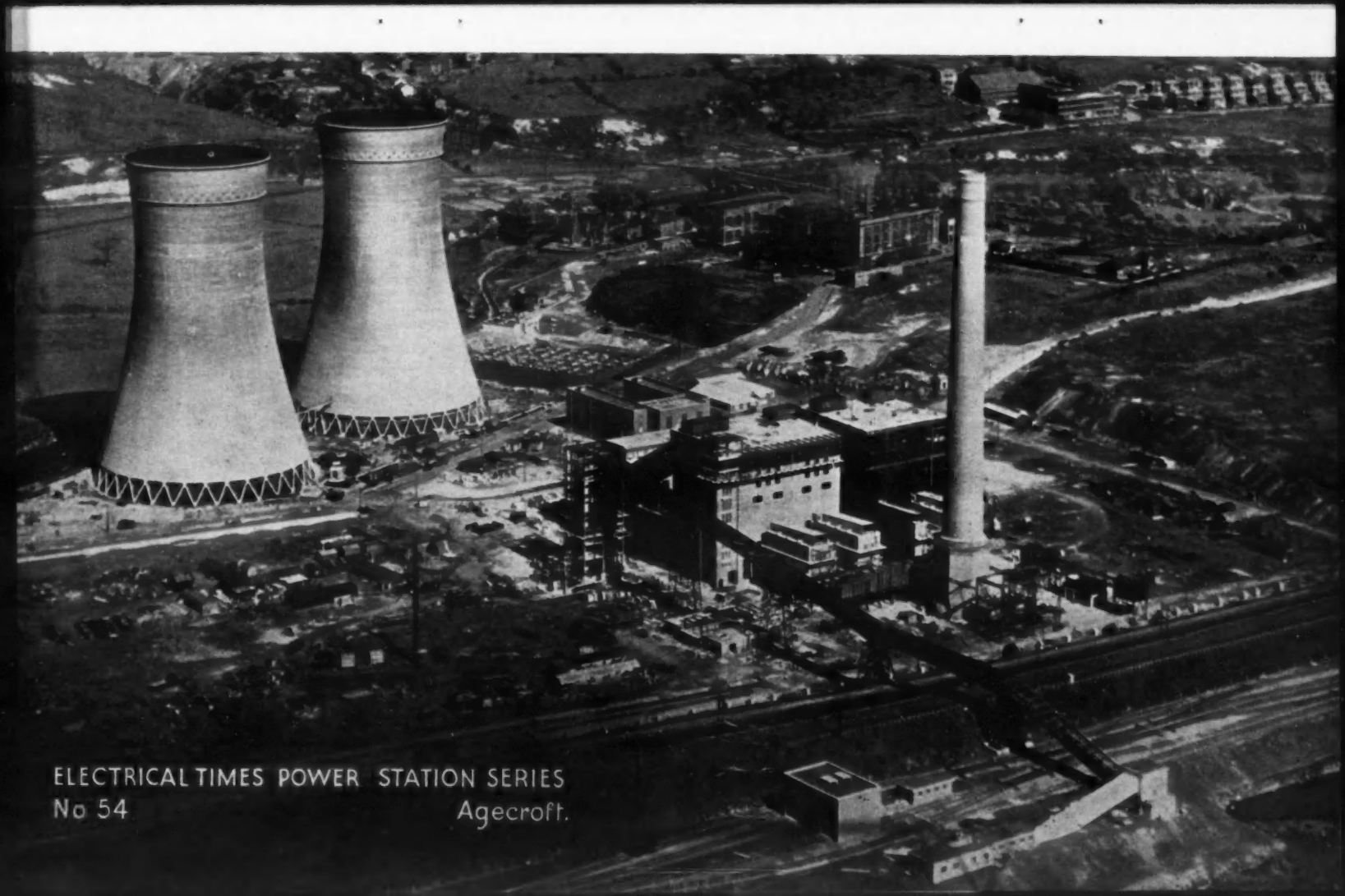
COMMON GROUND

DAM DESIGN and clay-puddling have this much in common for us—we recognise them as the province of the civil engineer, and as typical mysteries of his art. These thoughts were in our mind as we entered the roomy library of the Civils' headquarters to view the exhibition arranged for their yearly Conversazione. It was all unnecessary, however, for there was a welcome air of familiarity about the displays, about half of them dealing directly or indirectly with electrical subjects. As we came to the end of our inspection of this fine collection of exhibits, we pondered upon the exchange between the two branches of engineering there typified—the strength and massiveness of the Civil to aid the more extensive electrical projects; the accuracy and precision of the Electrical to give sure foundation to structural researches. We were, indeed, developing these thoughts into a theme fit for grandiloquent expression when we were brought back to a sense of urgency by the last example of the Electricals' infiltration—a crystal controlled clock, reminding us of the time factor that besets all engineers.

Meteor

THIS WEEK'S PHOTO

THE new Agecroft generating station, in the North-Western Division, B.E.A., on which work is well advanced, is to have an ultimate capacity of 200 MW. The first section, of 100 MW, will comprise two 50 MW turbo-generators of Metropolitan-Vickers manufacture, generating at 33 kV, with four 315 k lb./hr. International Combustion pulverised fuel-fired boilers. Steam pressure will be 625 lb/s.i. at 850° F. Boiler feed make up water will be taken from the Thirlmere Aqueduct and passed through evaporators. Two condensers per turbo-generator are being installed, and the circulating cooling water will be passed through the two 312 ft. high cooling towers each of 3,080,000 gal./hour capacity. The main circulating water pumps are located near the turbo-generator houses, water being pumped from the River Irwell to settling tanks to the tower. Electrostatic precipitators are being installed. Arrangements have been made for fuel supplies to be brought in by rail and road, the station belt conveyor system being capable of handling 400 tons/hr.


ELECTRICAL TIMES POWER STATION SERIES
No 54
Agecroft.

Transmission Line Charts

Modified Evans and Sels Charts for Transmission Line Investigation

by J. R. MORTLOCK, Ph.D., B.Sc.(Eng.), M.I.E.E., M.A.I.E.E.

WHEN a number of operating conditions involving transmission lines is to be investigated and recourse must be made to calculation, a considerable reduction in the labour is possible if performance charts are available. There are many types, useful for particular problems, but those due originally to Evans and Sels, particularly their modified version as typified by Figs. 4 and 6, are probably the most useful. Moreover, they are easy to use and give results rapidly. These charts were referred to in a previous article on power flow control.*

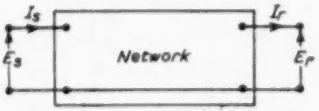


Fig. 1. General 3 terminal network

Balanced three-phase circuits can be considered as consisting of three separate identical single-phase circuits, the analysis of one of which is representative of all three.

Each single-phase circuit can be reduced to a three-terminal network, Fig. 1, the input and output voltages and currents being related by the general equations

$$\left.\begin{aligned} E_s &= AE_r + BI_r \\ I_s &= CE_r + DI_r \end{aligned}\right\} \quad \ldots\ldots\ldots\ldots (1)$$

and

$$\left.\begin{aligned} E_r &= DE_s - BI_s \\ I_r &= CE_s + AI_s \end{aligned}\right\} \quad \ldots\ldots\ldots\ldots (2)$$

where **A, B, C, D** are constants, generally complex and functions of the network resistance, reactance, capacitance (or susceptance) and leakance. If the network is symmetrical,

$$A = D \text{ and more generally}$$

$$AD - BC = 1 \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Tabulations of expressions giving these constants in terms of the circuit values are available [1, 2, 3], and a small selection is given in Table 1. Circuit 1 represents a simple series impedance and, for example, can be used for a short line with capacitance neglected or a transformer with magnetising current neglected. Circuit 2 represents a simple shunt admittance and can be used for transformer magnetising current or shunt capacitors. Circuits 3 and 4 are the nominal τ and π and are used for representing approximately circuits with distributed constants (series resistance and reactance and shunt capacitance and leakance; the last is usually neglected), for example, overhead lines up to about 100 miles in length. For longer lines or where a high degree of accuracy is essential, the expressions in 5 will have to be used. If the **A, B, C, D** constants for individual circuits are known, the overall constants for combined circuits can be determined for series and parallel arrangements from 6 and 7.

In practically all cases the numerical computations have to be accurate to five or six figures and are beyond the range of ordinary slide rules. Logarithms are tedious, but a manual or motor-driven desk calculator, which can multiply and divide, will considerably expedite the work.

Assume that for a particular network the constants **A, B, C, D** have been determined and it is desired to know the terminal conditions over a range of operation. This can be done by one set of detail calculations which enable charts to be constructed from which voltages MW and MVARs can be determined for the required conditions. The derivation and construction of the receiving end chart will be considered in detail first.

Receiving End Chart

From (1) $E_s = A\,E_r + B\,I_r$

$$C = A\angle\alpha\, E_r + B\angle\beta\, I_r \quad \ldots\ldots (4)$$

where

$$\left.\begin{aligned} A &= A\angle\alpha = a_1 + ja_2 \\ B &= B\angle\beta = b_1 + jb_2 \end{aligned}\right\} \quad \ldots (5)$$

Taking E_r as the reference, the vector diagram corresponding to (4) will be as shown in

*"Watts Volts and Vars" ELECTRICAL TIMES Jan. 26, Feb. 9, 1950

Fig. 2. Loci of constant voltage magnitudes will be arcs of circles with O as centre. The current $\mathbf{I}_r$ can be split into its in-phase and quadrature components I_{pr}, I_{qr} respectively: similarly the voltage $\mathbf{B}\,\mathbf{I}_r$ can be split into its corresponding components $\mathbf{B}\,I_{pr}$, $\mathbf{B}\,I_{qr}$, and as $\mathbf{B}$ is a constant the latter are proportional to power and vars if $\mathbf{E}_r$ is a constant. In general this will not be the case, but if all the vectors in Fig. 2 were multiplied by E_r/B (the diagram would be the same as this factor is only a numeric) these two components would be

$$B\,|\beta.\ I_{pr}E_r/B = I_{pr}E_r\,|\beta$$
$$B\,|\beta.\ I_{qr}E_r/B = I_{qr}E_r\,|\underline{\beta}$$

and as $|\beta$ is a constant they would represent watts and vars and axes through the termination of the vector $\mathbf{AE}_r$, i.e. point O^1, parallel to these modified vectors could be used as power and var axes.

If this is done it is necessary to know with reference to these axes, the co-ordinates of the constant voltage loci centre O, and the radii of these circular loci. The derivation of the required expressions is given in Fig. 3, and the general equation to the E_s locus is

$$\left(P_r+\frac{a_1b_1+a_2b_2}{b_1^2+b_2^2}E_r^2\right)^2+\left(Q_r+\frac{a_2b_1-a_1b_2}{b_1^2+b_2^2}E_r^2\right)^2 = \frac{E_s^2E_r^2}{b_1^2+b_2^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

or

$$\left(\begin{matrix}\text{abscissa dis-}\\ P_r-\text{placement of}\\ \text{O from O}^1\end{matrix}\right)^2+\left(\begin{matrix}\text{co-ordinate}\\ Q_r-\text{displacement}\\ \text{of O from O}^1\end{matrix}\right)^2 = \text{locus radius}^2$$

where P_r = Power received and Q_r = Vars received.

Equation (7) as it stands is not of much use as the co-ordinates of the centre are functions of E_r^2, but by dividing it through by E_r^4 the co-ordinates of the centre, O^1, will be constant

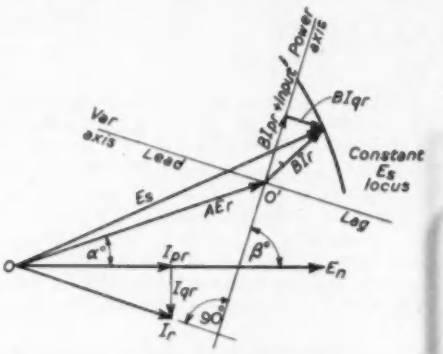


Fig. 2. Vector Diagram for $E_s = AE_r + BI_r$

in magnitude at the expense of making the power and var scales functions of $1/E_r^2$. The equation so modified will now be

$$\left[\frac{P_r}{E_r^2}+\frac{a_1b_1+a_2b_2}{b_1^2+b_2^2}\right]^2+\left[\frac{Q_r}{E_r^2}+\frac{a_2b_1-a_1b_2}{b_1^2+b_2^2}\right]^2 = \frac{1}{b_1^2+b_2^2}\left(\frac{E_s}{E_r}\right)^2 \quad \ldots\ldots\ldots\ldots (8)$$

Normally the receiving end voltage has a

Fig. 3. Derivation of co-ordinates of point O referred to point O' and the power and var axes

$\mathbf{A}=a_1+ja_2$ and $OQ=a_1E_r$ $O^1Q=a_2E_r$

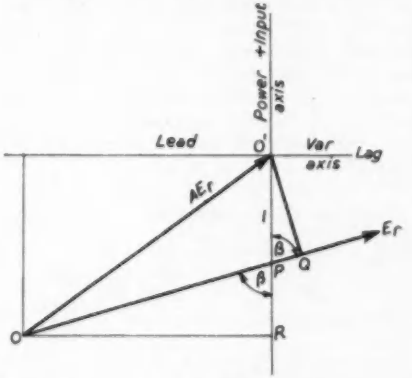
$\mathbf{B}=b_1+jb_2=|B|\,|\beta$ Tan $\beta=b_2/b_1$ Cot $\beta=b_1/b_2$ Sin $\beta=b_2/|B|$ Cos $\beta=b_1/|B|$

$$OR=OP\ \text{Sin}\ \beta=(a_1E_r-PQ)\text{Sin}\ \beta=a_1E_r\ \text{Sin}\ \beta - a_2E_r\ \text{Cot}\ \beta\ \text{Sin}\ \beta$$
$$=a_1E_r\ \text{Sin}\ \beta-a_2E_r\ \text{Cos}\ \beta=\frac{a_1b_2-a_2b_1}{|B|}E_r$$
$$O^1R=O^1P+PR=(a_2E_r/\text{Sin}\ \beta)+OP\ \text{Cos}\ \beta=(a_2E_r/\text{Sin}\ \beta)+(a_1E_r-PQ)\ \text{Cos}\ \beta$$
$$=\frac{a_2E_r|B|}{b_2}+\frac{a_1E_rb_1}{|B|}-\frac{a_2E_rb_1}{b_2}\cdot\frac{b_1}{|B|}=\frac{a_2E_r}{b_2}\left[|B|-\frac{b_1^2}{|B|}\right]+\frac{a_1b_1E_r}{|B|}$$
$$=\frac{a_2E_r}{b_2}\left[\frac{b_2^2}{|B|}\right]+\frac{a_1b_1E_r}{|B|}=\frac{a_2b_2+a_1b_1}{|B|}E_r$$

Introducing the multiplying factor $E_r/|B|$ in the revised diagram

$$OR=\frac{a_1b_2-a_2b_1}{|B|^2}E_r^2=\frac{a_1b_2-a_2b_1}{b_1^2+b_2^2}E_r^2$$
$$O^1R=\frac{a_2b_2+a_1b_1}{|B|^2}E_r^2=\frac{a_2b_2+a_1b_1}{b_1^2+b_2^2}E_r^2$$

also radius for constant E_s locus $=\dfrac{E_sE_r}{|B|}$



and equation of locus referred to O^1 is

$$\left(P_r+\frac{a_2b_2+a_1b_1}{b_1^2+b_2^2}E_r^2\right)^2+\left(Q_r+\frac{a_2b_1-a_1b_2}{b_1^2+b_2^2}E_r^2\right)^2 = \frac{E_s^2E_r^2}{b_1^2+b_2^2}$$

nominal value; let this be V_r. If now (8) is multiplied through by V_r^4 the resulting equation will be

$$\left[\frac{P_r}{\left(\frac{E_r}{V_r}\right)^2}+\frac{a_1b_1+a_2b_2}{b_1^2+b_2^2}V_r^2\right]^2+\left[\frac{Q_r}{\left(\frac{E_r}{V_r}\right)^2}+\frac{a_2b_1-a_1b_2}{b_1^2+b_2^2}V_r^2\right]^2=\frac{V_r^4}{b_1^2+b_2^2}\left(\frac{E_s}{E_r}\right)^2 \quad \ldots\ldots(9)$$

which represents a family of circles with the co-ordinates of the centre, referred to the power and var axes as

Power: $P_{ro}=-((a_1b_1+a_2b_2)/(b_1^2+b_2^2))V_r^2=$ a constant ..... (10)

Vars: $Q_{ro}=-((a_2b_1-a_1b_2)/(b_1^2+b_2^2))V_r^2=$ a constant ..... (11)

and with radii which vary with the ratio of E_s to E_r, for any ratio the value being

$(E_s/E_r)(V_r^2\sqrt{(b_1^2+b_2^2)})=$ a constant $x(E_s/E_r)$ ..... (12)

From (9) it is evident that the abscissa and ordinate scales vary with $(E_r/V_r)^2$ and are direct reading only when the nominal and actual receiving end voltages are equal.

A typical diagram is shown in Fig. 4. The phase displacement angles between E_r and E_s are readily obtained as for $I_r=0$, $E_s=AE_r=AE_r\angle\alpha^\circ$ and the angle between the line joining the centres O and O^1 and E_r is α°: This enables the polar net required to complete the chart to be immediately located.

It should be noted that for power into the receiver strictly the power is negative and cognisance will have to be taken of this when considering the sending end chart: in conformity with custom the power scale on the receiver chart is shown as positive, although strictly it should be negative. Furthermore, leading vars are also shown as positive.

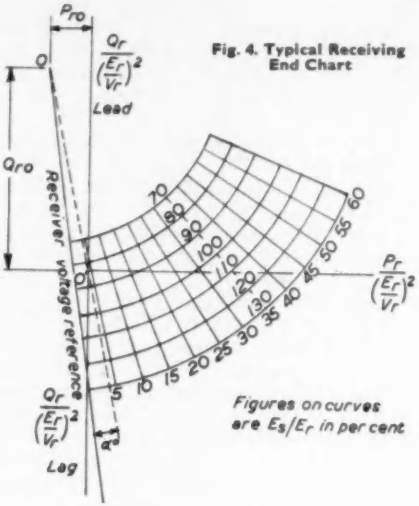


Fig. 4. Typical Receiving End Chart

Sending End Chart

The basic equation for the receiver end voltage in terms of the circuit constants and the sending end voltage and current is

$E_r=DE_s-BI_s$ ..... (2)

and proceeding as in the derivation of the receiving end chart the vector diagram representing (2) will be shown in Fig. 5. The power and var scales are the reverse of those in Figs. 2 and 3 as output as distinct from input is being considered.

The equation to the constant E_r voltage loci can be determined in the same manner as for the receiving end chart and is,

$$\left[\frac{P_s}{\left(\frac{E_s}{V_s}\right)^2}-\frac{d_1b_1+d_2b_2}{b_1^2+b_2^2}V_s^2\right]^2+\left[\frac{Q_s}{\left(\frac{E_s}{V_s}\right)^2}-\frac{d_2b_1-d_1b_2}{b_1^2+b_2^2}V_s^2\right]^2=\frac{V_s^4}{b_1^2+b_2^2}\left(\frac{E_r}{E_s}\right)^2 \quad \ldots\ldots(13)$$

TABLE I

	Circuit	General circuit constants $\bar{A}$	$\bar{B}$	$\bar{C}$	$\bar{D}$
1	S — Z — R	1	Z	0	1
2	S — Y — R	1	0	Y	1
3	S — ½Z — Y — ½Z — R	$1+\frac{ZY}{2}$	$Z\left(1+\frac{ZY}{4}\right)$	Y	$=A$
4	S — ½Y — Z — ½Y — R	$1+\frac{ZY}{2}$	Z	$Y\left(1+\frac{ZY}{4}\right)$	$=A$
6	S — A_2 B_2 / C_2 D_2 — A_1 B_1 / C_1 D_1 — R	$A_1A_2+C_1B_2$	$B_1A_2+D_1B_2$	$A_1C_2+C_1D_2$	$B_1C_2+D_1D_2$
7	S — A_1 B_1 / C_1 D_1 — A_2 B_2 / C_2 D_2 — R	$\frac{A_1B_2+B_1A_2}{B_1+B_2}$	$\frac{B_1B_2}{B_1+B_2}$	$\frac{C_1+C_2}{(A_1-A_2)(D_2-D_1)}$ $\frac{}{B_1+B_2}$	$\frac{B_1D_2+D_1B_2}{B_1+B_2}$
8	Line with distributed constants: Z=total series impedance: Y=total shunt admittance	$\cosh\sqrt{ZY}$ $=1+\frac{ZY}{2}+\frac{Z^2Y^2}{24}+\cdots$	$\sqrt{\frac{Z}{Y}}\sinh\sqrt{ZY}$ $=Z\left(1+\frac{ZY}{6}+\frac{Z^2Y^2}{120}+\cdots\right)$	$\sqrt{\frac{Y}{Z}}\sinh\sqrt{ZY}$ $=Y\left(1+\frac{ZY}{6}+\frac{Z^2Y^2}{120}+\cdots\right)$	$=A$

Z=Impedance Y=Admittance

the co-ordinates of the centres, referred to the power and var axes being

Power: $P_{so} = ((d_1b_1+d_2b_2)/(b_1^2+b_2^2))V_s^2 =$ a constant .....(14)

Vars : $Q_{so} = ((d_2b_1 - d_1b_2)/(b_1^2+b_2^2))V_s^2 =$ a constant .....(15)

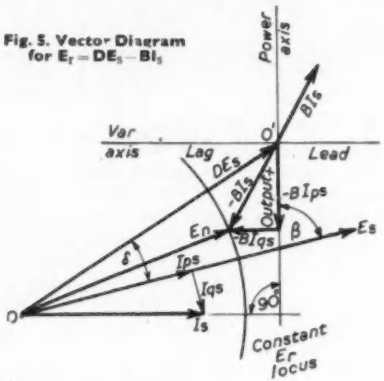
and the radii, which are functions of the ratio of E_r to E_s, being

$(E_r/E_s)(V_s^2/\sqrt{(b_1^2+b_2^2)}) =$ a constant x (E_r/E_s) .....(16)

The polar net can be located from the condition that when $I_s=O$, $E_r = DE_s|\delta^o$, i.e. the displacement between the voltage vectors is δ^o or the angle between OO^1 and OE_s is δ^o. A typical chart is shown in Fig. 6.

(Note.—For symmetrical circuits $A=D$ and $a_1=d_1$; $a_2=d_2$; $|\alpha=|\delta$ and if $V_s=V_r$ a considerable simplification in the actual drawing of the charts results.)

Fig. 5. Vector Diagram for $E_r = DE_s - BI_s$



Practical Details

Essentially the charts are for single-phase circuits and as such can be used for three-phase balanced circuits by modifying the scales.

Assuming the watts and vars scales are to use three-phase MW and MVAR units, then, for example, the general equation (9) will be

$$\left[\frac{P_r\times10^6}{3\left(\frac{E_r}{V_r}\right)^2}+\frac{a_1b_1+a_2b_2}{b_1^2+b_2^2}\ \frac{V_r^2\times10^6}{3}\right]^2 + \left[\frac{Q_r\times10^6}{3\left(\frac{E_r}{V_r}\right)^2}+\frac{a_2b_1-a_1b_2}{b_1^2+b_2^2}\ \frac{V_r^2\times10^6}{3}\right]^2 = \frac{V_r\times10^{12}}{9(b_1^2+b_2^2)}\left(\frac{E_s}{E_r}\right)^2 \quad \ldots\ldots\ (17)$$

where P_r = 3-phase power, MW
= 3 x single-phase power
Q_r = 3-phase vars, MVAR
= 3 x single-phase vars

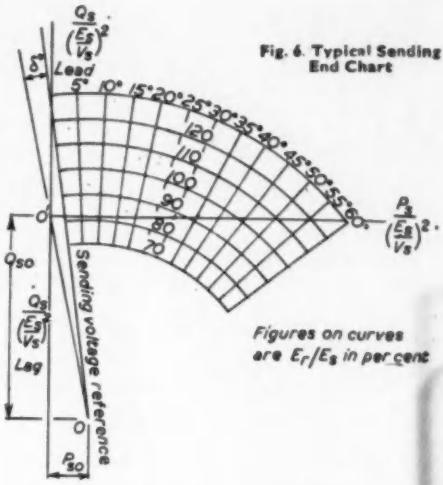


Fig. 6. Typical Sending End Chart

E_r, V_r, E_s = Line to line voltages kV
= $\sqrt{3}$ x phase voltages.

An examination of (17) will show that the numerical factor $(10^{12}/9)$ can be cancelled through and that the resulting expression will be identical with (9).

Similarly for the sending end expression (13) can be used as given if P_s, Q_s are three-phase MW, MVAR and all voltages are line to line in kV.

Use of Charts

To transfer from one chart to the other it is necessary to know the angle between the voltages and the ratio of the voltages.

For example: it is required to know the sending end voltage, power and vars when the receiving end voltage, power and vars are given. The procedure is:—

(i) Determine $(E_r/V_r)^2$
(ii) Determine $P_r/(E_r/V_r)^2$, $Q_r/(E_r/V_r)^2$
(iii) Using the values determined in (ii) enter the receiving end chart and find (E_s/E_r) and the displacement angle.
(iv) Enter the sending end chart with (E_r/E_s) and the displacement angle and determine the scale values of the power and vars.
(v) Determine $(E_s/V_s)^2$
(vi) P_s(actual) = Scale value x $(E_s/V_s)^2$
(vii) Q_s(actual) = Scale value x $(E_s/V_s)^2$

REFERENCES

1 *Electrical Transmission and Distribution Reference Book* (Westinghouse Electric and Manufacturing Co., 1942), p. 97.
2 *Power System Interconnection*, H. Rissik (Sir Isaac Pitman and Sons, 1940), p. 9 *et seq.*
3 *Electric Circuits, Theory and Applications*, Vol. I, O. G. C. Dahl (McGraw-Hill Publishing Co. Ltd., 1928), chap. 9, p. 246.

Our readers' views . . .

B.E.P.C. Convention

AS usual, the excellent Manufacturers' Exhibition was reserved for "Delegates Only" for four days. Most of them had no practical interest in the exhibits.

Almost every stand was of direct personal and commercial interest to the electrical contractors. The heroic few of these who attempted to view, were compelled to scrum with hordes of idle spectators on Friday. Why does B.E.A.M.A. support B.E.A. in this studied insult to the private enterprise which created the industry?

This is Britain 1950, and if I put my name to this I would lose my job.

Bitter Rep.

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Advertising of Vacancies

IN a recent letter, I made a statement that I thought the time was ripe for all vacancies now to be advertised nationally and I felt sure that all in the industry who were desirous of making progress would support this suggestion.

It seems, however, that perhaps I am mistaken and that, generally speaking, members of the industry are well content with the present arrangements as the only response was from Mr. F. J. Cooper, who disagrees.

I agree with Mr. Cooper that the local man should have preference, provided that all candidates have similar capabilities, but how can this be assessed without advertising the vacancy?

In my earlier letter, I raised a point regarding the transfer of an officer from one Board to another, apparently without any public advertisement. Most of the Boards and the Central Authority, I believe, employ P.R.O.s and I am certain that my enquiry has not been overlooked, but maybe it was considered not worthy of a reply.

In my opinion, an important principle is involved and I would ask that an official reply be given to the following points:—

1. What is the official B.E.A. policy with regard to filling vacancies, or do each Board operate their own special system?

2. Is it usual for appointments to be made from within one Board to another Board without any public advertisement appearing?

Nomad

◆ ◆ ◆

Radiant Boiler Plates

I WOULD like to comment on one or two points in Miss Whitgift's letter in your issue of June 22. I noted with interest her remarks on the well-known advantages of simmerstat-controlled boiling plates. Surely, these advantages hold good when using the grill-boiler, whether this be radiant or solid type.

Assuming an ordinary meal consisting of soup, sausages, vegetables and steamed pudding. The obvious part of the cooker to use is that designed for the job, viz. the grill-boiler, but, if there is no flexible control, then the housewife will use the variable-controlled boiling plate for the pudding and soup, and the grill-boiler for the vegetables and sausages. Two plates, where only one is necessary if simmerstat controlled.

When grilling, I have the heat full on to seal the food and brown it, and then turned down to cook the food through. If the heat is kept full on and regulation obtained by moving the food, a great deal of heat is wasted, while, with low heat, the food soon dries up if left for any length of time. From my own experience, the answer to efficient use of the grill is to have it continuously controlled.

Another point is simplicity. One stumbling block when attempting a conversion to electric cooking is the complexity of the controls. A housewife has to understand an oven thermostat, a 3-heat switch on the grill, a simmerstat on the boiling plate, possibly another simmerstat or switch on a second plate, and, finally, a mains switch—complexity, indeed, to the user of gas cooker. Why not make things easy and automatic—give it tap-like control throughout—a real answer to critics.

Jean M. Clapperton

Excellent Attendance at the 13th Session

THE thirteenth session of the International Conference on Large Electric Systems (C.I.G.R.E.), now being held at Paris, bids fair to prove the most successful of the series. Speaking at the opening, M. R. A. Schmidt, president of C.I.G.R.E., pointed out that the idea of the conference had originated some 29 years ago. The membership in 1921 was 250 members; now over 40 countries were represented. This growth of membership had made some difficulty in obtaining suitable accommodation.

This year, some 850 ladies were present, three times as many as in 1948, which showed that the C.I.G.R.E. members appreciated the importance of the social aspect. He stated that the members were devoted to their profession and that C.I.G.R.E. showed a definite and fundamental aspect of co-operation.

Lightning and Surges

The afternoon of the first day was devoted to a discussion on the papers dealing with lightning and surges. Four papers dealt directly with lightning phenomena. Messrs. M. Bockman and N. Hylten-Cavallius (321) described an automatic c.r.o. allied to a magnetic recorder, which measured the amplitude and duration of a stroke, and also included an arrangement for indicating when the steepness of the wave front exceeded a certain critical value. Messrs. Harald Norinda and Oskars Salka showed from model experiments that the polarity of lightning was an important feature in the type and frequency of occurence of the discharge, and also deduced that good conductivity of subsoil was a factor in the formation of lightning nests. R. H. Golde described the work done in Great Britain, and K. Berger, who acted as special reporter to the section, reported on the Committee of Studies No. 8 "Lightning and Surges."

The discussion consequent on these papers was opened by M. Bodier (Electricité de France), who pointed out that about 20 years ago the Russians had carried out tests showing that the earth conditions were important in as far as the results of lightning strokes were concerned. He then showed and described a new equipment designed to record the frequency and intensity of lightning.

Dr. R. H. Golde of the E.R.A. pointed out that with most equipment, if the time between successive strokes was less than 10 millisec, only one discharge was registered. The E.R.A. had had oscillographs in constant use for two years and they were most reliable; the cathode ray tube was usually good for 2,000 hours or more. He stated that a negative stroke was more likely to hit a transmission line than a

Photo shows M. R. A. Schmidt, President of the Conference, speaking at the opening session

positive one. From a general study of the height of the leader stroke, he thought that there could not be such things as lightning nests. Mr. F. J. Miranda (G.B.) gave some results of experiments carried out with a 1/50 wave produced by a surge generator and applied across a sand-filled air-gap. M. Laurent (France), however, gave a warning that tests carried out with surge generators on a small scale were difficult to scale up dimensionally to the true situation.

On the question of surges, the main paper under discussion was No. 314, "Propagation of Surge Generator Waves up to 850 kV on a 132 kV Line," by M. Bockman, N. Hylten-Cavallius and S. Rusck. This particular paper was produced as a result of experimental investigations carried out in the field to verify a theory for the alternation of waves on high-tension lines without earth wires. Both S. Rusck (Sweden) and Hylten-Cavallius spoke in the discussion, the latter pointing out that on one occasion, when testing a 120 kV line, they had a 30-kV line running in close proximity (some 60 metres away) and they found that the lightning arrestors operated frequently on the lower voltage line due to inductive coupling. He though that this might be the cause of some hitherto unexplainable results obtained from records taken from lower-voltage lines.

The fact that below corona level, surges on a 3-phase line could be regarded as a combination of two different types of waves, one system propagating between phase and earth, and the other between the different phase conductors, was emphasised both by S. Rusck and Dr. K. Berger.

Statistics and Overvoltages

The two main papers on the statistical analysis of lightning were Nos. 333 and 306, the former giving the principles of the statistic method of collecting information proposed by the Committee and the latter, by Dr. R. H. Golde, containing the data derived in England and giving details of the method of analysis adopted and the manner in which the information was collected. In the discussion, Dr. Golde objected to the South African method of obtaining lightning stroke data by field strength measurements, stating that the South African thunder-cloud was characteristic in that the strokes were in nearly every case, of the same polarity, while in European countries both positive and negative discharges could and did occur. A careful individual analysis carried out in England, using only persons who had been close to a lightning stroke to earth at the moment of occurrence,had shown that the average was 6 flashes/sq mile/annum. Dr. J. S. Forrest also took part and showed some slides illustrating the connection between lightning faults on the Grid system, interruptions to supply, and transformer failures.

Impulse Testing

The general question of impulse testing still appears to present many difficulties, both in application and in usefulness. Dr. Stromberg (Sweden) gave some data of impulse testing carried out on an alternator winding, and thought that it was really only necessary where one turn windings were concerned. Dr. Lindholm, also of Sweden, considered that some of the present methods of calculating the surge effects on generators, connected to line through delta-star transformers, were wrong, as in practice the generators were seldom damaged by surges.

Mr. W. Szwander (G.B.) was most doubtful about the protection against surges afforded by

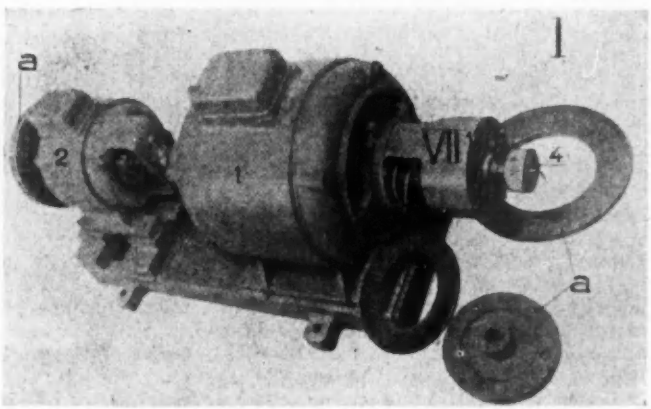


Fig. 1. Photograph illustrating the set-up of a micro-unit. (1) Micro-alternator. (2) Micro-turbine. (VII) Induction-type alternator locating the position of the rotor. (4) Phonic wheel (speed regulator)

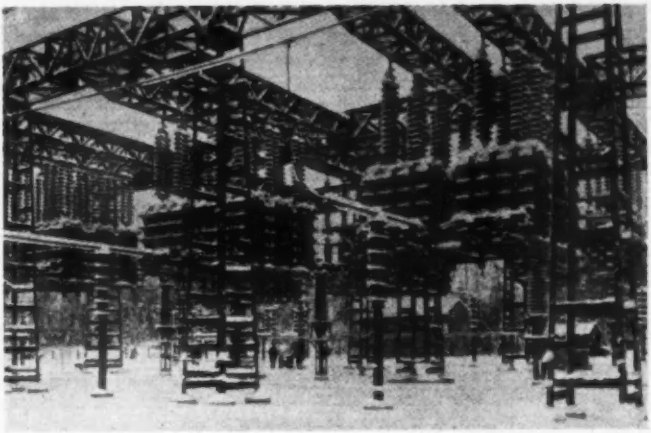


Fig. 2. The series capacitor plant at Alfta. Sieverts groups in the foreground with ASEA groups in rear

a length of cable between the generator and line, and quoted two papers, one of English origin, which considered that the longer the cable the better, while the other—American—said that there was a critical length. He pleaded for a full scale investigation to be made into the problem. Mr. F. Descans (Belgium) was also doubtful about the protection recommended on both sides of a h.v. transformer connected to a generator.

Dr. J. R. Mortlock came in solidly on the side of non-linear resistor-type surge divertors for generators, and to illustrate his point, showed some graphs and photographs of an experimental scale representation of a system.

Finally, M. Laurent (France) said that they had had little trouble with surges through the 220 kV transformers connected directly to their generators. As the generator side was delta connected, the surges would, in any case, be between phases, and he doubted if arrestors could do much to reduce the surges.

System Stability

The second day was devoted entirely to a discussion on the papers presented on system stability—load and frequency control being the main points. As was, however, inevitable, the question of network analysis became of major importance. The first paper to come under criticism however, from quite a number of speakers, was No. 325—the Report of the International Study Committee on System Stability and Load Frequency Control. This particular paper contains a preliminary section giving definitions, nomenclature and symbols of the terms to be used in power system stability problems. That the Committee itself was not exactly happy about this section was shown by M. Dietsch who opened the discussion and asked for members to send their observations on the definitions as laid down, to the Committee. However, the discussion soon came round to the question of network analysis and computation. Mr. D. Luccia (U.S.) read communications from Messrs. Dunston and Jessel suggesting that the ideas given in Paper 338, by R. Robert (France), on micromachines and microreseaux should do much to help on system stability due to the high operating speed which beat the differential analyser and the network analyser.

Owing to the undoubted importance of these machines in the field of stability studies, it may be worth while considering briefly the system described in the original paper.

The whole basis of operation is founded on methods of similarity such as are used in the solution of problems in fluid mechanics. A complex network is thus represented by the "microreseau" which consists of rotating machines and non-rotating elements which are, essentially, both in the steady state and in the transient state, an electro-mechanical representation of the machines and equipment of the full-scale system under consideration. Thus transient studies can be carried out without any of the complex computation required by the network analysers, and the miniature system is, so to speak, a "model railway" representation of the actual network.

Dr. R. Lindholm (Sweden) gave brief details of a Swedish network analyser, operating at a standard frequency of 50 c/s, in which the difficulty of producing the large inductances required had been overcome by representing all components (inductance resistance and capacity) by rotating the vectors backward

through 90°. Inductance could then be represented by negative impedance elements which could easily be carried out by using electronic circuits. He also described a method of eliminating instrument errors. Mr. R. O. M. Powell (G.B.) approved of the idea of defining system stability terms but suggested some amplification was necessary. He doubted if it was wise to replace step by step methods of analysing system stability by a continuous method, but thought the latter might be useful if the former showed that the system under consideration was possibly unstable.

Computing Machines

Dr. J. R. Mortlock pointed out that it was generally assumed that the time of carrying out a network analysis was due to the time of computation. He then described a computer designed for stability studies which had made the limiting time function that of setting up the analyser. In connection with modern computing machines he said that he had seen one at Cambridge capable of handling 11 x 11 matrices.

M. Belfils (France) emphasised the importance of having a rigid nomenclature and vocabulary in connection with system stability analysis but he was somewhat doubtful of some of the terms as laid down. On the question of analysis, he thought the differential analyser very useful. The trouble with the normal network analyser was to get sufficient elements to represent a complicated system. When it came to the microreseaux, the economic problem came to the fore.

The history of the differential analyser in the U.S. was briefly given by Mr. E. Shea who envisaged a time when this type of machine could be used to indicate automatically the most economical method of loading for large interconnected systems, thus simplifying or eliminating the work of the load dispatcher.

Nomenclature again was referred to by Mr. F. J. Lane (G.B.) who stated that there were two parties concerned with any system analysis —the people who worked out the computations and operated the analysers and the engineers who gave them basic data and accepted their results. Any system of nomenclature to be adopted must cater for both classes. On the economic side, a network analyser worked out at about £40,000, a microreseau at £65,000 and a differential analyser as much as £100,000. M. Cahen (France) considered the microreseau the best form as it had no limitations. The only thing against it was its cost. It was ideal for high-speed reclosure and series capacity studies, and, in any case, in his opinion, the high speed of operation of a microreseau made it economical. M. E. Hubert (Belgium) who, incidentally, was an excellent interpreter for this group, described a cheap network made for high-speed reclosure studies using similitude laws.

Regulation and Governing

The final part of the session was devoted to questions of regulation and governing and was dominated almost entirely by the hydro-electric engineers from Sweden and Switzerland. It was generally agreed that the governor should be electrically assisted to cope with sudden load changes. The French viewpoint was given by Messrs. Anciaux and Belfils. Last speaker of the session was Mr. Hochrainer (Austria) who described an installation in Vienna of three micro power stations with electronic devices to alter the effective inertia of the micro-turbo-alternators.

After the discussion, an excellent film was shown of the series capacitor plant installed in the Swedish network at Alfta. This installation is in a 220 kV line, 480 km long and has a rated power of 31 MVAR. The increase in power-carrying capacity of the line has amply justified this particular installation.

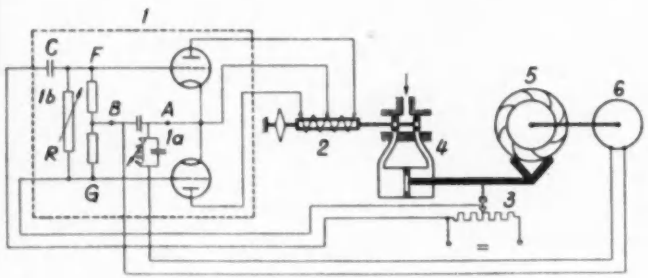


Fig. 3. Diagram of electrically operated governor. (1) Electronic regulator. (1a) Resonance circuit. (1b) Damping circuit. (2) Electro-hydraulic device. (3) Gate shaft potentiometer. (4) Servomotor and valve. (5) Gates. (6) Tacho-meter generator

Problems and Practice

IN ENGINEERING

Intermittent Faults

THE most difficult fault to trace is the one which is non-existent. Everyone is aware of the intermittent fault which clears itself in the most exasperating fashion on the approach of a repair man. Even a high-voltage test can fail, at times, to disclose the "earth," or a l.v. heavy current be unable to show up an occasionally faulty contact. The following incident is an interesting variation on spasmodic trouble.

A 2,000 cu ft chill was temperature-controlled by a thermostat. At odd times the chamber would fail to maintain its 36° F limit for no apparent reason. Each part of the circuit was examined carefully and found to be in perfect condition.

The thermostat was subjected to tests and showed no sign of being out of order. Finally, when the production manager lost patience completely, the instrument was replaced by a new one. Next morning the goods were again found to have suffered from heat.

A vibration recorder was borrowed from the transport department and strapped to the compressor to indicate the hours of running of the machine. That night and for the next fortnight everything was normal. Then the fault re-established itself and the chart showed an exceptionally long rest period during the night.

The electrician elected to remain after hours and make tests when the machine stopped. He sacrificed his sleep needlessly for it behaved blamelessly.

The next evening he was sent for as the watchman noticed that the thermometer had risen considerably. Rather hopelessly he climbed on top of the cabinet and examined the thermostat. The contacts were open. When "shorted", the machine started up normally. In the confined space he was decidedly uncomfortable as a nasty draught was blowing on his neck from an open window. He shut this and climbed down.

To his surprise, the compressor started up. That set him thinking on the right lines. On the "bottle" end of the capillary, the increasing temperature of the chamber had been causing expansion of the operating medium of the instrument. It was freezing hard outside and the chilly air blowing through the open window was striking the bellows and nullifying the effect so that the contacts remained open.

Securing the window had cured this trouble completely.—*W. H. A.*

Shock Through Blown Fuses

I WAS called into a garage the other day to put some plugs in order which failed to work, yet a shock had been received off the flex where the insulation was faulty and a voltmeter registered full voltage.

Apparently, the fuses had "blown" and someone had reloaded them with some burnt-out winding wire which was oxidised, having a high resistance. On reloading the fuses with new wire, the plugs worked properly.—*R. T.*

Reconnection of Field Coils

CALLED up to investigate burnt-out field coils, the owners explained that to replace the broken-down motor, the only machine available was a 20 b.h.p., 500 V, 800 r.p.m., d.c. machine. The speed required to replace the motor under repair was round about 400 r.p.m and the power required about 10 b.h.p. The manager said they had a new electrician—he had commenced a fortnight before. Up to this breakdown, his work had been very satisfactory. He didn't know what he did but dense smoke came from the machine after running for about a couple of hours. He wanted to be perfectly fair to the man. It might not be his fault —would I investigate.

The electrician explained that two supplies were available, 500 and 250 V. I asked him to make a rough sketch of the manner in which he reconnected the field coils. The machine was a four-pole one. After arrow-chalking the coils he reconnected in series-parallel—perfectly correct. Now, as to the cause of the field burn-out: on tracing the history of this motor—it was about six months since the machine was in use on a normal 500-V supply. Complaints had been made by the previous electrician that the field coils were rather hot. The obvious explanation was that when operating on its normal 500 V supply, the field coils were partially burned out, or shorted prior to reconnection on the 250 V circuit.

Let A, B, C, D, represent the four coils having a total resistance of say 500 ohms when new. Current on 500 V supply one amp. Partial burn-out on the 500 circuit.

A, say 120 ohms; B, 120 ohms; C = 50 ohms; D, 50 ohms. Total resistance 340 ohms. Current on 500 V—1·4 amp. On reconnecting for 250 V current on coils C, D = 2·5 amp or an increase of 250%. I may add that the management were very pleased with the explanation as it removed any doubt as to the capabilities of their new man.—*F. Mackintosh.*

Drilling Copper

WITH reference to your contributor F. S. and his difficulty of drilling copper strips for bus bars, I hope the following will be of interest to him and your readers.

The main essential when drilling copper, as indeed any material, is that the right type of drill is used, sharpened correctly, run at the best speed for the job in hand and an ample supply of lubricant is available, if necessary.

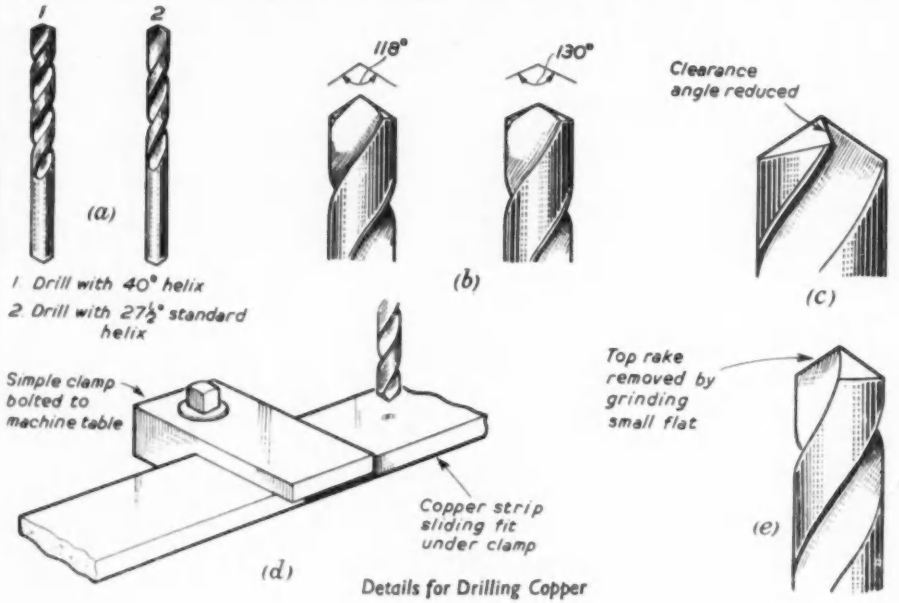
So often is a drill used, with complete disregard of the fact that it was sharpened a week ago and since has been used to drill steel, brass, etc., indiscriminately, consequently producing holes which invariably need at least another operation to de-burr them.

The standard twist drill preferably H.S.S. is quite suitable for drilling copper. A drill having a helix angle of 40° against the usual 27½° is also recommended for copper (*a*). To prevent the drill digging in the soft copper it should be sharpened with a point angle of some 130° in preference to the usual 118° (*b*) or the clearance angle may be reduced by grinding a small flat just behind each cutting edge (*c*).

With drills sharpened as above the drillings will come straight up the drill. A high spindle speed with a light feed regulated to prevent the drill rubbing should be used. With an ample supply of lubricant this method gives good results and will prevent any tendency of the drill to grab the work.

A simple clamp on the lines as sketched should provide adequate protection for the work and worker (*d*). The polishing of the drill flutes will assist in easier ejection of the drillings. If it is desired to break up the chips from the drill a method is to grind the drill off centre slightly and remove the rop rake from the shorter lip as shown in (*e*). With this method slower speeds and coarser feeds are necessary as removing the top rake from the drill means more pressure is required; also an oversized hole will be produced.—*G. B. Maskery.*

Contributions to this page dealing with specific items of interest to electrical engineers and maintenance men are welcome, and, if accepted, will be paid for at our standard rates. Contributions should be written on one side of the paper only and may be accompanied by sketches, which will be re-drawn for publication.



Details for Drilling Copper

School Lighting Economics

The Choice of Fittings for the Modern Classroom

by F. J. FARMER

AS the need for the greatest possible economy in the costs of constructing new schools is becoming established, the provisional sums introduced into the estimates to cover the specialist services are becoming subject to close scrutiny with a view to effecting reductions. The lighting installation is not immune from such attention, but decisions to reduce should not be taken without being fully aware of the essentials of good lighting.

The Ministry of Education require 10-ft candles, i.e. 10 lumens per sq ft on the working plane, as a minimum degree of illumination in all classrooms and this stipulation is mandatory for all types of school from the primary upwards. The need for such intensities for primary schools is apt to be challenged in some quarters owing to the short hours of use and the lack of long periods of close work and visual concentration, the suggestion often being made that caretakers do not require 10-ft candles merely to clean the school. However, economies that can easily be effected by reducing standards and which are in direct proportion to the degree one is prepared to defy the regulations, are outside the scope of this treatise. As the old Board of Education recommended 10-ft candles for classrooms in 1936 and the modern recommendations of other responsible bodies are for still higher intensities, the lowering of the standard should not be undertaken without very careful consideration.

Choice of Fitting

For any given area of working plane, the watts required to produce a specified degree of illumination varies as the "co-efficient of utilisation." This factor is the percentage—expressed as a decimal fraction—of the total lumens output of the lamps employed that can be utilised on the working plane. The value of this co-efficient is affected by various circumstances, i.e. the dimensions of the room, the reflection value of the ceiling and walls, the suspension height of the fitting in relation to the working plane and the ceiling, and most important of all, the type of fitting or reflector used to house the lamp.

The choice of fitting is governed by considerations of good lighting practice—other than the intensity on the working plane—such as the need to avoid glare, either direct or reflected, and the necessity of keeping the brightness factor of the light source as low as possible. To complete the list of requirements, the fittings should harmonise with the room to satisfy the aesthetic conceptions of the architect and must meet the specification of the engineer in respect of robustness, the fixing arrangements and the electrical safety measures.

For each set of circumstances there is, therefore, a minimum amount of watts to be employed below which the specified degree of illumination would not be obtained. By taking the best conditions obtaining in a modern classroom of area 528 sq ft (say, 24 ft by 22 ft) and applying the accepted basic formula for arriving at the co-efficient of utilisation and subsequently the illumination on the working plane, the performances as charted in Table 1 can be established. The formula used allows for depreciation of the reflecting surfaces of the room, and the gradual lowering of the lamp output throughout its life.

From Table 1, it will be seen that in each example given, except "A", the total area of the classroom, i.e. 528 sq ft, can be covered by the particular method. As, however, the use of chalkboard lighting is now standard practice, the points producing the general lighting of the room can, if necessary, be sited to ignore two or three feet of the teaching end of the room, so concentrating more of the available lighting on the working area of the room occupied by the desks. Admitting this possibility, the area to be dealt with becomes $22 \times (24-3) = 462$ sq ft, or $24 \times (21-3) = 456$ sq ft, as the case may be, either of which being near enough for all practical purposes to the area of 450 sq ft covered by example "A", which shows that the *absolute minimum* tungsten lamp wattage required to produce the Ministry of Education's standard of 10 lumens per sq ft in classrooms of approximately the dimensions given, is 900 W (6×150), plus chalkboard lighting. The housing of these six 150-W lamps in common open opal type reflectors constitutes the cheapest possible method of conforming to the regulations, both in respect of capital costs and running charges. Needless to say, this type of lighting, aesthetic-

ally and optically, leaves much to be desired and with only 900 W employed, the required intensity can only be obtained by accepting open-type reflectors. As the use of 200-W lamps in open reflectors, as in "B", still further aggravates the disadvantages of example "A", it is outside the scope of good practice, except for industrial situations or where mounting heights are, or can be considerably above the normal obtaining in classrooms.

With the concentration of the points over the working area, rendered permissible by the introduction of the chalkboard lighting, either of schemes "C" or "D" will produce above 10-ft candles, together with a better quality of lighting with less risk of discomfort due to direct or reflected glare. The capital costs and the running charges—1,200 W against 900 W—are higher than for scheme "A", showing that, although the intensities are not greatly exceeded, the extra quality has to be paid for. Scheme "D", including only four fittings, housing 300-W lamps, might appear to be cheaper in capital costs than "A", but in fact, the extra cost of the large 16-in. diameter fitting above the cost of the reflectors used in "A", is greater than the saving in installation costs expected by wiring only four points instead of six.

Table I.—Lighting of Classroom 24 ft by 22 ft = 528 sq. ft area

Scheme	Size of Lamp	Fitting	Typical Section of Fitting	Co-efficient of Utilisation	Area over which 10 l.s.f. is produced	No. of Fittings	Total Area dealt with	Watts used
					sq ft			
A	150 W ...	Good opal glass reflector open at the bottom with good "cut-off," 11 in. to 12 in. diameter		0·47	75	6	450	900
B	200 W ...	Do. 12 in. to 13 in. diameter		0·47	102	6	612	1,200
C	200 W ...	General diffusing type of fitting, totally enclosed, 14 in. diameter; smallest and cheapest form, the sphere		0·41	89	6	534	1,200
D	300 W ...	Do. 16 in. diameter		0·41	145	4	580	1,200
E	5 ft Fluorescent tube. Nominal 80 W. Actual 90 W	Open type 5 ft. fluorescent fitting —'Seagull' pattern, flat batten or semi-reflector type fixed on the ceiling		0·4	98	6	588	540

Fitting Sizes

In establishing the minimum watts to produce the required illumination, the minimum size of the fittings and glassware to house the lamps is also established. These sizes, recommended by the majority of manufacturers for enclosed units, are shown in Table 1.

It must be noted, however, that two large firms at least accept responsibility for the use of 200-watt and 300-watt lamps in 12 in. and 14 in. spheres respectively, but the consensus of opinion is against this practice owing to heat dissipation troubles and the higher surface brightness.

Whether the fittings are suspended from, or mounted directly on to the ceiling, the size is governed by the necessity of providing adequate housing for the specified lamp, although the shape can vary within prescribed limits from the sphere, which is used in this thesis as the basic design. Departure from the sphere, however, has a tendency to reduce the apparent size. The use of six 14 in. diameter spheres, or four of 16 in. diameter, or even eight 12 in. spheres housing 150-watt lamps, in classrooms of the size under review, might be considered aesthetically objectionable, such objections being more readily sustained the lower the ceiling becomes. Indeed, the use of only four 12 in. or 14 in. spheres has been known on occasions to cause apt, if impolite, comment. The reader can partly test his reactions to the proportions by drawing a cross-section of a typical classroom and sketching in the fitting required to the same scale, and then varying the height of the ceiling.

Ceiling Height

If the proposals to achieve an economy in the cost of the construction of schools by materially lowering the height of the classrooms are implemented, it may be difficult to produce 10-foot candles on the working plane by means of ordinary tungsten lamp lighting, without the sources of light becoming objectionably heavy and obtrusive, and without contravening the Ministry of Education's regulations in respect of mounting height, which requires that no luminous portion of a general lighting unit shall be lower than 9 feet from the floor.

The introduction of fittings sunk flush with the surface of the ceiling might be offered as a solution, particularly where ceilings are low. Units large enough to house the size of lamps required, or alternatively, a multiplicity of smaller units, would have to be used, however, and such suitable flush fittings are expensive to buy and install. Further, in many of the roof constructions now being employed on school buildings, the available depth is so small that flush fittings would have to be specially designed and mounted in specially prepared cavities, the resultant costs being disproportionately high. A larger amount of electricity would be required to produce a result equal to general diffused unit lighting, and as the ceiling would only be illuminated by reflection, sharp contrasts between the light sources and the surrounding surfaces would exist and the general effect is likely to be unsatisfactory.

Another possible method of reducing the domination of the room by the lighting fittings might be to employ the flat saucer—elliptical in section—type of ceiling fitting, when the depth of the projection from the ceiling can be limited to a maximum of 7 in. or 8 in. This type of fitting, however, cannot house a 200-watt lamp, and a number of smaller lamps mounted horizontally within each fitting must be employed. Assuming the economic number of fittings to be used over the working area to be six, then expensive fittings of at least 16 in. diameter would be required housing one of the combination of lamps as given in Table 2 to provide the equivalent of a 200-watt lamp.

TABLE 2

No.	Size	Total Watts	Lumens Output	Lumens per watt	Percentage efficiency compared with 1-200 W
4	60 W	240	2660	11.083	81.34
3	75 W	225	2649	11.773	86.4
2	100 W	200	2540	12.7	93.2

The loss of efficiency up to 18%, is a factor that cannot be dismissed in an economic survey. In addition to the expense of the fittings and the loss of efficiency, there is the shortening of the life of the lamps that are used in the horizontal position to be reckoned with, the whole becoming an appreciable disadvantage and a considerable charge to aesthetics.

Fluorescent Lighting

Both methods of avoiding the use of the large fittings required by schemes "C" and "D" can be expensive in capital costs and, by reason of the higher wattage and lowered efficiencies, in running charges. There still remains scheme "E" employing fluorescent lighting, but the capital cost can at first sight be alarming.

The economic difference between fluorescent and tungsten installations* can be approximately assessed by amortising the extra capital cost into an extra cost per annum (depreciation and interest) and setting this against the saving

* See "The Electrical Times", November 27, 1947; "Lighting Economics"; "The Builder", December 26, 1947.

in the charges for electricity. The amount of saving is, of course, governed by the load factor of the installation and the tariff. For a particular tariff there is an amount of use per annum above which the savings exceed the expenditure and the fluorescent lighting installation becomes the cheaper.

Tariffs for school lighting are high, and this factor, by increasing the amount of saving possible, lessens the gap between the two systems. Lest this statement be challenged, it should be noted that the majority of the apparently cheaper "all-in" tariffs covering all services in the building, are based on the use of a much greater amount of electricity per annum than usually obtains in schools, so that unless a particular school is used intensively during the evening, the high flat rate charges for the lighting are almost invariably found to be the most economical. Generally, it can be shown that at a flat rate tariff of 5d. to 6d. per unit for lighting (which incidentally prevails over a large part of the country), the lighting system must be used for approximately 50 hours per annum for each £1 of difference between the cost of supplying and fixing a tungsten or fluorescent unit of equivalent light output before economic equality is attained. As the difference in cost between a 14 in. sphere housing a 200-watt lamp and its lighting equivalent, a 5 ft fluorescent fitting, can be as much as £4 to £8, it follows that a user of from 200-400 hours per annum at this tariff is indicated before fluorescent lighting can be economically justified. Technical schools and modern secondary schools with an active evening Institute may attain this use, and for these, despite the heavy initial costs, fluorescent lighting will be cheaper. For primary and junior schools, however, where the use of artificial lighting for teaching purposes is often as low as 50-100 hours per annum, fluorescent lighting cannot normally be justified when economies are pressed for.

When, on aesthetic grounds, the *necessary* bulk of the normal enclosed unit tungsten fitting is objectionable, or where, because of comparatively low ceilings, such fittings are definitely unacceptable, recourse must be made to the use of either the flush type, the saucer fitting, or fluorescent lighting. If expensive flush fittings or saucer type fittings are employed, with the added cost of overcoming the fixing and constructional difficulties, it follows that the difference between the capital costs of these types and fluorescent fittings is considerably less than for ordinary spheres, etc., lessened maybe to a point when, even for primary schools, an economic balance is obtained and fluorescent fittings can be introduced.

As shown in Table 1, scheme "E" will provide over 10-foot candles on the working plane for the particular application, and the fittings need not project below the ceiling more than 4 in. to 6 in. The types of fluorescent fittings shown are the simplest and cheapest possible, but the actual tube is naked and unscreened. The surface brightness of fluorescent tubes can be tolerated without "disability glare," however, at all angles of more than 30° taken from the horizontal through the eye to the light source. Taking the horizontal distance from the eye of the rearmost child to a point below the front fitting in a classroom of the size under review at 14 ft to 15 ft, then Tan 30° x 14 ft or 15 ft will give the vertical height of 8 ft 1 in. to 8 ft 7 in. from the eye to the fitting. Assuming 3 ft as the distance from the floor to the eye of a seated child, a minimum height for the suspension of bare tubes is established at 11 ft 1 in. to 11 ft 7 in. from the floor, if objectionable glare from the light source is to be avoided. It follows, then, that when suspensions appreciably lower than these are dictated by construction, troughing or screening for the lamp should be employed if the principles of good lighting are to be observed to the full. In actual practice, however, lower suspension heights might be tolerated without undue discomfort.

Summary

Assuming a normal classroom of 520-540 sq ft with chalkboard lighting as an established feature, the cheapest possible method of producing 10 lumens per square foot on the working plane is by means of six 150-watt lamps, housed in open shades or reflectors. The quality is poor and the intensity just barely attained.

Better quality lighting can be obtained by using enclosed diffusing units, but six 200-watt lamps, or four 300-watt lamps, in 14 in. or 16 in. diameter fittings, must be employed, but the size of the fittings might be objectionable.

As an alternative, saucer ceiling fittings or flush types could be used, but these are expensive and comparatively inefficient.

In general, the installation of fluorescent lighting is a long-term economy in technical schools and evening institutes, despite high initial costs, and in the case of the primary schools should be seriously considered when the size of the ordinary enclosed unit is found to be objectionable, and the use of saucer type or flush fittings is contemplated.

Pithead Generation

Report on German Practice by N.C.B. Chief E. and M. Engineer

PITHEAD generation of electricity from low-grade coals has many advocates, and the increasing cost of coal transport has reinforced their arguments in this country. Particular interest therefore attaches to some notes on a visit to German and Dutch collieries made last year by a N.C.B. team headed by Mr. B. L. Metcalf, B.Sc., A.R.T.C., M.I.E.E., M.I.Mech.E., the Board's chief electrical and mechanical engineer.

Boiler Trends

Pressures of 600 lb/sq in. were common in 1930, and pressures of 900 to 950 lb/sq in. are nowadays regarded as quite moderate, operation and maintenance under these conditions being considered no more difficult than at 600 or 400 lb/sq in. The German engineers consider the trend to be towards higher pressures and temperatures, and regard it as commercially prudent to design accordingly rather than risk a station becoming technically and economically obsolete during its planned life. As a result, 77 boilers of over 600 lb/sq in. rating produce 22% of the industry's total steam usage, while new boilers are 930 lb/sq in. standard where possible, low pressure steam being obtained from the high-pressure turbine exhaust.

To minimise the first cost of coal preparation plant, a considerable proportion of middlings together with untreated slurry is used as a basic fuel for the pithead boiler house. Thus the capacity of the pithead plant is determined by the amount of low-grade fuel available rather than by direct power requirements. The surplus electrical energy is sold outside the industry, and the coal production engineer regards coal preparation plant and power plant as complementary units.

The fuels received by the boiler house vary considerably, especially when a central coal preparation plant serving a number of pits feeds it. Ash contents of 25% to 35% with peaks of 45% are common, though moisture content is usually below 20% due to the admixture of middlings, coal breeze, etc. Coal from low-grade seams is fed directly from the mine to the boiler-house without preparation.

Joint Planning

Joint planning of pithead stations is at present adopted, the aim being to build a special transmission line connecting all collieries, so permitting a reduction in the amount of standby plant required and also the sale of bulk supplies to public companies. New power stations use high-pressure turbines and supply compressed air to outside collieries up to 4½ miles distant, and low-pressure steam up to 2½ miles away. Energy consumption of all kinds is equal to 113 kWh/ton of coal mined.

DETAILS OF GERMAN COLLIERY POWER STATIONS

Name of Pit	Total Electric Capacity MW	Total Capacity Compressed Air cu.ft./min.	Steam Conditions lb/sq in.		No. of Boilers	Steam Generating Plant			
			H.P.	L.P.		Type of Boiler	Capacity k lb/hr	Firing Equipment	Fuels Burnt
Scholven	111·5	80,400	1,560 810° F.	380 800° F.	6 1) 6)	Benson Natural circulation	120 to 150 150 to 200 70	Martin Stokers and Kramer Mills	Middlings, slurry Dry dust, filter cake (mixed)
Rheinbaben	26·5	91,800	1,200 930° F.	170 520° F.	3 2	Benson Benson	50 to 70 80 to 110	Martin Stokers and Kramer Mills	Middlings Slurry
Schlaegel und Eisen	55	54,000	1,200 915° F.	170 504° F.	4	Benson	110 to 130	Kramer Mills	Middlings and slurry (mixed)
Hansa	12·5		920	180	4	Schmidt-Hartmann	80 to 90	Martin Stokers	Middlings, slurry, coke breeze (mixed)
Emscher Lippe	20·5	60,000	1,000	400	2 1	Natural circulation	55 65 66	Martin Stokers and P.F. from central grinding plant	Middlings, aspirated dust, slurry, coke breeze

overseas news

Greek Hydro-Electric Programme

Approval by the United States Government of an immediate implementation of the Greek Government's hydro-electric programme has been announced by the American Ambassador in Athens. Implementation of this programme, which was drawn up a year ago following a survey by the American EBASCO Company, had been held in abeyance until the Greek Government could secure the counterpart in drachmas required for its execution. It is hoped that the budget now being prepared will permit the use of funds sufficient to assure proceeding with the whole programme, otherwise it will be necessary to curtail one of the projects until a future date.

Queensland Regional Boards

The Queensland Government, on the advice of the State Electricity Commission, took a very courageous and far-sighted step when it planned the orderly electrical development of the State, Mr. S. Cochran, chairman of the Commission, said when addressing the conference of State Regional Electricity Boards last month. The problems facing Queensland's electricity authorities were infinitely more complex than those of authorities elsewhere in the Commonwealth, he said, because of the sparsely populated nature of Queensland territory. The authorities took the wise view that if the country was to be held it must be developed, and that there was no more necessary corollary of national development than the provision of electricity to as many people over a wide area as quickly as possible.

Another speaker told the conference that the population of areas served with electricity had increased between 1938 and 1949 from 679,250 to 849,319. The number of consumers had increased from 149,000 to 263,000. There was still a great deal of work to be done, but the pattern of electrical development was clearly defined. Commissioning of the Wide Bay station about the end of 1950 and the operation of Capricornia and Townsville stations during 1951 would mark the successful conclusion of the first stage of the State plan. The connection of Wide Bay with South Burnett would follow, and commissioning of the Tully Falls hydro-electric station, already under construction, would complete a remarkable programme of regional electrification.

Brisbane Development

Erection of about 82 miles of o.h. line will cost the Brisbane City Council £113,000 during 1950-51, the Lord Mayor, Ald. Chandler, stated last month, when presenting the provisional estimates to the Council. The electricity department expects to connect a further 6,000 new homes in the next 12 months; and to install about 1,500 street lights. Among the estimates of expenditure for the year are: o.h. mains £168,500, underground mains £400,000, and transformers and switchgear £585,000. In preparation for the operation of the Tennyson power station, it is proposed to lay, during the year, two inter-connection cables between the New Farm power house and the Tennyson station, a distance of about seven miles.

Victoria's Record

Using all its available plant, both steam and hydro-electric, the State Electricity Commission of Victoria successfully carried a record load of 504 MW on June 20, between 8.15 a.m. and 8.30 a.m. The Commission has pointed out, however, that the load was a warning as well as an achievement, and with two months of winter ahead, it was urgent for consumers to ease their demands by strict observance of restrictions and economising in the early mornings.

Television in Australia

As we foreshadowed last week, the Australian Cabinet has now approved plans for the establishment of television in Australia. Announcing this step, Mr. H. L. Anthony, Postmaster-General, said the first experimental station would be a 625-line type and would be finished in Sydney in about two years. He added that the Government would amend the Australian Broadcasting Act which prohibited private enterprise participating in television.

Snowy Mountains Scheme

Work on the Snowy Mountains hydro-electric scheme would not draw too heavily on manpower and materials needed for other Commonwealth and State works, the Minister for National Development, Mr. R. G. Casey, stated in the House of Representatives last month. Between 200 and 300 skilled engineers would be needed for the project, but only 70 of them would be recruited in Australia. The Government was advertising in Britain and other countries for engineers, and a senior officer of the Snowy Mountains Authority was overseas interviewing applicants. Some 11,000 workers were employed on the project at present.

A European Pool?

Under a new European plan for pooling power supplies, France, Benelux, Italy, Germany and Austria will be the founder-members of the "Union of Electricity Producers of Western Europe" if their Governments ratify

a 30-year agreement which has been approved by O.E.E.C. Initially, only a small proportion of power generated will go into the pool—approximately 950 MW, drawn mainly from the frontier regions. The countries taking part are required to pool supplies from power stations built as part of the Marshall Plan emergency programme, but they can voluntarily add other power stations to the scheme. Other countries can join the Electricity Union and a board of representatives of each Government will decide how supplies are to be switched from one country to another, and will fix prices. Under the proposals, the board could also advise the Governments concerned on the need for new stations or other improvements. The treaty establishing the union is to be binding for 30 years.

Berlin's Power

At midnight on Friday last, the East German authorities cut off the supply of power to Western Berlin, as had been anticipated. Before the blockade, Western Berlin was almost entirely dependent on the Soviet Zone power station of Klingenberg, which supplied some 80 per cent. of Berlin's requirements. But during the blockade the rebuilding of the Spandau station in the British sector was undertaken, many of the parts being flown in on the air lift. It is not anticipated that there will be any serious disruption. The new power plant is being put into operation, and if necessary, five small standby plants will be used.

The St. Lawrence Plan Again

The U.S. Federal Power Commission, last month, heard a further plea by the New York State Power Authority seeking a licence to construct, with the Province of Ontario, a hydro-electric plant in the International rapids section of the St. Lawrence River. For the Authority it was stated that New York's retarded electrical development called for prompt and effective relief; only seven states showed a lower electricity usage. In opposition it was reported that a Federal Power Commission examiner had already recommended that the Authority's application be rejected, and that the U.S. Government itself should develop the U.S. portion of the river's resources for both power and navigation. The Commission was urged to confirm the examiner's findings, for to do so would be in line with President Truman's view that the power development should not be started unless, at the same time, construction of the St. Lawrence seaway could be undertaken.

Madras Programme

The Madras Government has decided shortly to approach the open market for raising capital for the State's irrigation and electricity schemes already in hand. The current year's budget provided for capital expenditure of Rs. 155 million, of which Rs. 120 million are to be spent on these schemes. The entire programme is expected to be completed by 1952, bringing under irrigation half a million acres of dry land and doubling power generation in the State.

Madras Project

Investigation into the possibilities of implementing the Kundah-Upper Bhavani hydro-electric project, Madras, is nearing completion. The project is expected to have a generating capacity of 100,000 kW. Power would be tapped under the proposed scheme from the Kundah and Upper Bhavani rivers. The intention is to connect the system with the Pykara. The ultimate cost of the scheme is expected to be Rs. 10 crores.

Egyptian Expansion

A further extension to the power station at Zagazig, one of the larger Egyptian market towns, was recently formally inaugurated by His Excellency Halim Bey Gad, Director of Mechanical and Electrical Services of the Ministry of Municipalities and Rural Affairs. This extension, by the way, is the fourteenth at the station since 1908. It comprises the first of two diesel-electric sets provided by the co-operation of Sulzer Bros. of Switzerland, who built the prime mover, and the General Electric Co. Ltd., who supplied the 595 kW alternator. Among those also present at the opening ceremony were Dr. Oscar Sulzer, of Sulzer Bros., Mr. C. S. Ickringill, Middle East representative of the G.E.C., and Mr. T. U. Lavarack of the Tractor and Engineering Co., S.A.E. agents for the G.E.C. in Egypt.

At the formal opening of Zagazig's latest extension

PERSONALITIES

IN THE INDUSTRY

Golfers from the four factories of Ferranti Ltd.—Hollinwood, Moston, Edinburgh and Canada—recently played for the trophy presented by Sir Vincent de Ferranti for annual competition. Edinburgh had been winners in 1947 and 1948, but Hollinwood, who won the trophy in 1949, were determined to retain it, and their efforts proved successful, **Mr. W. G. Murdoch,** on the Sales Staff, playing over the course of the North Manchester Golf Club proving to be the winner with the fine score of 90—19=71 nett, 5 shots under bogey. Edinburgh's best was **Mr. Bigg's** 72 nett on a 74 course, while **Mr. Brunning** of Canada did 71 on a par 70 course. Mr. Murdoch will hold the trophy for 12 months and receive a replica for permanent retention.

To succeed Mr. F. G. Quance, A.M.I.E.E., who retired last month, the General Electric Co., Ltd., has nominated **Mr. P. E. Wheatland** as manager of the company's accessories department. Mr. Wheatland joined the G.E.C. in 1912, and was engaged in the counting house and engineering department prior to service in the 1914-18 war. Returning, he spent a period at Witton works and then joined his father's firm, H. C. Wheatland and Co., to gain electrical installation experience. Rejoining the G.E.C. four years later he worked in the small motors and fans department, and in 1932 transferred to the sales department, where he remained till 1939, when he joined the firm's government and railways department. He was appointed assistant to Mr. F. G. Quance in the accessories department in 1946. Mr. Wheatland will also represent the company on the B.E.A.M.A. accessories section and has already been appointed to the standing and technical committees of that body.

Mr. P. E. Wheatland

The Jackson Electric Stove Co., Ltd., announce the resignation of **Mr. T. J. Lattimer** who entered the electric heating industry in 1920 as chief designer to the Electric Heating Co. Mr. Lattimer joined the Jackson Electric Stove Co., Ltd. in 1930 and was technical engineer to the company.

Mr. L. J. E. Hooper, chairman and joint managing director of Doulton and Co. Ltd., has resigned his position as joint managing director, but will still retain his office as chairman; the Board have appointed **Mr. E. Basil Green** to be managing director of the company.

Walsall Conduits Ltd. announce the appointment of **Mr. F. N. Crabtree** as manager for their Nottingham and Sheffield branches, as from July 1. He has transferred from the firm's Coventry branch where he has been branch manager for 16 years. Mr. Crabtree's new sphere includes Derbyshire, Nottinghamshire, North Lincolnshire and South Yorkshire.

Mr. F. N. Crabtree

Chosen as station superintendent of the new Rye House generating station, Eastern Division, B.E.A., is **Mr. W. H. Mason,** who has occupied a similar post at the Watford power station since vesting day. Educated at Manchester Grammar School, he received technical education at Manchester College of Technology and served as a pupil with the Stockport Corporation Electricity Department from 1919 to 1923. After a short period at Barton power station, Manchester, he served for nine years on the electrical staff of the Burma Oil Co. Ltd., Upper Burma, and the Nigerian Railways, West Africa. Returning to Britain in 1934, he joined the staff of the Northmet Power Co. at Taylor's Lane station. He takes up his new duties on August 1.

Mr. W. H. Mason

Recently appointed London sales manager of Huwood Components Ltd. (Domestic Appliance Division) is **Mr. E. C. Green,** who has resigned his position as manager of the Domestic Appliance Department of Thorn Electrical Industries Ltd. He is well known throughout the trade, not only in connection with Thorn's, but also because of his long association with H.M.V. Household Appliances Ltd.

Mr. E. C. Green

Until recently with the Lighting Department of the British Thomson-Houston Co., **Mr. T. Catten,** F.I.E.S., has joined Falk Stadelmann and Co., Ltd., as departmental manager at their head office. He obtained early electrical instruction at Regent Street Poly, and served for a time with Troughton and Young, Ltd., before joining the staff of the E.L.M.A. Lighting Service Bureau, then at 15 Savoy Street. There he gained an extensive knowledge of lighting matters, becoming a specialist in the commercial and industrial fields. He assisted in the opening of the Manchester Bureau, and its operation for the first year, after which a further three years were spent in London before being appointed district engineer to the Lighting Service Bureau of Scotland in 1930. That position he held till 1937 when he joined the Lighting Department of the B.T.H. Co. Since the war he has devoted much of his time to marine lighting matters, being responsible for contracts on some of the largest liners.

Mr. T. Catten

Chairman of the State Electricity Commission of Queensland, since its inception in 1945, **Mr. S. F. Cochran,** F.F.I.A., has now been nominated chairman of the Commonwealth–New South Wales Joint Coal Board.

London manager to Walsall Conduits Ltd. since January, 1949, **Mr. E. Peacop** has been elected to the board of directors. He has been connected with the firm's sales organisations for the past thirty years.

For many years technical director of Ardente Acoustic Laboratories, Ltd., **Mr. P. Hickson** has joined the John Lewis Partnership, Ltd., as director of buying for radio, television and all electrical appliances.

His many former pupils will be interested to learn that **Prof. R. O. Kapp,** B.SC., M.I.E.E., is to retire at the end of September next, after 15 years' tenancy of the Pender Chair of Electrical Engineering, University College, London. More usually associated with the educational side of the industry, it is not widely known that Prof. Kapp had a lot to do with the institution of the National Grid Scheme, being at the time employed by Kennedy and Donkin, whom he joined in 1913. He assisted in the original report and, on the approval of the Regional Schemes he became responsible for the layout and design of technical features of the system, and estimation of costs, and also for the selection of some o.h. line routes. After 1929 he was put in charge of all work in the North-Western and North Wales district scheme. In 1935 he was appointed to the Pender Chair at University College, London, and he has been a Senator and the Dean of the Faculty of Engineering in the University for the past four years. He is author of numerous books.

Prof. R. O. Kapp

At present station superintendent at Earley generating station, Southern Division, B.E.A., **Mr. L. E. Brickwell** has been selected for a similar position at the new station at Poole, Dorset. He will be succeeded at Earley by **Mr. C. J. Stockell,** B.SC.(Eng.), A.M.I.E.E., A.M.I.Mech.E., A.M.Inst.F., who is now assistant station superintendent there. Mr. Brickwell joined the Stirling Boiler Co. in 1929, and became efficiency engineer at Hayle power station in 1942, subsequently holding the same position at Little Barford until his appointment in September, 1944, as deputy superintendent at Earley. He has been station superintendent there since vesting day. Mr. Stockell received training with Crompton Parkinson, Ltd., West Ham undertaking and Hackbridge Electric Construction Co. Ltd. He joined the Portsmouth Corporation Electricity Department as junior engineer in January, 1939, successively holding various posts in the generating station until September, 1947, when he became mechanical engineer at Meaford power station. A year later, he became assistant station superintendent at Earley.

Mr. L. E. Brickwell

Mr. C. J. Stockell

OBITUARY

We note the death, on June 24, of **Mr. T. J. Penny,** director of Austin Bros. Electrical Co. Ltd.

The death occurred on June 16 of **Mr. A. R. Page,** A.M.I.Mech.E. A.M.I.E.E., Northern Area manager for J. H. Tucker and Co., Ltd. He had been responsible for Tucker interests in the North of England for the past 25 years.

The death has occurred in Cape Town of **Mr. G. W. Moore,** aged 77, who, until his retirement in 1936, was manager and a director of Automatic Telephone and Electric Co., Ltd.

Mr. Alexander Lindsay, M.I.E.E., principal of the Glasgow firm of that name, died recently, aged 74.

I.E.E. PREMIUM AWARDS

The Council of The Institution of Electrical Engineers has made the following award of premiums for papers read or accepted for publication during the session 1949-50:—

GROUP A.—*Institution Premium* to J. D. McGee, M.SC., PH.D.; *Kelvin Premium* to Prof. H. G. Booker, M.A., PH.D., and Mr. P. C. Clemmow; *John Hopkinson Premium* to D. W. Fry, M.SC., J. Dain, M.A.; H. H. H. Watson; H. E. Payne, B.SC.(ENG.); F. K. Goward, M.A.; J. D. Lawson B.A.; J. J. Wilkins B.SC.; and R. Carruthers B.SC.(ENG.).

GROUP B.—*Non-Section Premiums* to P. F. Soper, B.SC.(ENG.), PH.D.(ENG.) (Llewellyn B. Atkinson Premium); H. R. Broadbent B.ENG. (extra premium); C. M. Cock (extra premium); and L. H. A. Carr, M.SC.TECH. (extra premium).

Measurements Section Premiums to W. S. Melville, B.SC.(ENG.) (Silvanus Thompson Premium); R. O. Carter, M.SC.(ENG.) and D. L. Richards, B.SC.(ENG.) (Mather Premium); S. F. Musson, B.SC.(ENG.) and R. E. Mell (extra premium); A. R. Boothroyd, B.SC., E. C. Cherry, M.SC., and R. Makar, B.SC. (extra premium); Prof. F. C. Williams, O.B.E., D.SC., D.PHIL. and Mr. S. W. Noble (extra premium); K. H. Stewart (extra premium); N. F. Astbury, M.A., T. Emmerson, B.SC., PH.D., and J. McFarlane, M.A. (extra premium).

Radio Section Premiums to F. E. Jones, M.B.E., B.SC., PH.D., and E. C. Cornford (Duddell Premium); L. G. H. Huxley, M.A., D.PHIL., and J. A. Ratcliffe, O.B.E., M.A. (Ambrose Fleming Premium); E. L. C. White, M.A., PH.D., and M. G. Harker, B.SC.(ENG.) (extra premium); J. L. Pawsey, M.SC., PH.D. (extra premium); B. Y. Mills, B.SC., M.E. (extra premium); W. T. Duerdoth, B.SC.(ENG.) (extra premium); J. E. N. Hooper, B.SC., and A. A. Kippax, B.SC.TECH. (extra premium); S. de Walden, DIPL.ING., and Mr. J. C. Swallow, M.A. (extra premium); G. Millington, M.A., B.SC., and G. A. Isted (extra premium).

Supply Section Premiums to A. T. Chadwick, J. M. Ferguson, B.SC.(ENG.), D. H. Ryder, B.SC., and G. F. Stearn, M.A. (Sebastian de Ferranti Premium); J. S. Forrest, M.A., D.SC. (John Snell Premium); and G. Lyon, B.SC.(ENG.) (extra premium)

Utilisation Section Premiums to F. W. Cox, B.SC.(ENG.), and W. E. Swale (Crompton Premium); R. T. Coe, M.A., M.SC.TECH., and D. F. Welch, M.A. (Swan Premium); and A. R. H. Thorne (extra premium).

GROUP C.—*Fahie Premium* to T. H. Flowers, and D. A. Weir; *Heaviside Premium* to H. J. Josephs; *Paris Exhibition* (1881) *Premium* to L. Gosland, B.SC.; *Overseas Premiums* (for senior members) to A. J. G. Gosling, B.SC.; and (for students and graduates) to J. W. Crompton, B.E.; *Students' Premiums* (value £10) to C. G. Hopper, B.SC.(ENG.), R. C. Orford, B.SC.(ENG.), K. F. Raby, M.A., and T. E. Schilizzi, B.A.; *Students' Premiums* (value £5) to H. Bateman, B.SC.(ENG.), P. G. Farley, B.SC.(ENG.), J. D. Harmer, B.SC., and P. G. Ross, B.SC.

Electrical Interest at the Civil Engineers' Conversazione

OF the attractive display of engineering models and scientific exhibits on view at the Institution of Civil Engineers' Conversazione last Thursday, at least half were of direct electrical interest. Foremost amongst these was the scale model of the 750 ft television mast at Sutton Coldfield. Well known from photographs that appeared in the technical Press, the mast yields a model that once more impresses for size combined with slenderness. Other subjects of recent illustration now modelled for three-dimensional appreciation were the B.B.C.'s proposed development of its 13-acre White City site and the E.R.A. wind-generator to be erected at Costa Hill, in Orkney.

There were further models on the electrical power side, too—this time in connection with wide schemes rather than individual items. The application of the Pimlico district heating scheme was shown; for instance, the glass-enclosed 500,000 gallon capacity accumulator vessel tower being especially prominent, while some of the grandeur of the 150 MW Owen Falls project could be imagined from the scale plan of the dam and its associated switch yard, and from the accompanying diorama which placed the scene in its proper background. Finally, there was a Perspex-walled and ceilinged model of the supersonic wind tunnel plant being built at the National Aeronautical Establishment, Bedford. This is of electrical interest by reason of the two 6,430 amp 4,825 kW d.c. compressor motors used.

The wide application of electric instrumentation ensured a full representation of this branch of electrical engineering, with ultrasonic weld detection, using c.r.o. indication, well to the fore. Two separate exhibits exemplify strain gauge technique, one in relation to aircraft structures and the other dealing with welded ships. Of more homely interest was the application of electric analogue methods, again with the c.r.o. as an indicator, to the study of the rate of heat flow through walls, which is an important factor in fireproof design.

In conclusion, the Institution deserves congratulations for assembling such an interesting collection of exhibits.

Power for the Printing Press

Electronic and Mechanical Speed Control compared by Reyrolle's

RELIABILITY is all-important in printing press drives, but this quality must be obtained at the least possible cost, and in view of the wide range of motor and control equipments now available, selection is a difficult matter. To give those responsible an opportunity of studying the various combinations of plant available, A. Reyrolle and Co. Ltd. last week staged a demonstration at their Hebburn works to which they invited representatives of the national daily Press and of printing press manufacturers.

Four main features characterise the successful printing press drive—fine inching control, uniform crawling at about 2% full speed, smooth take over from crawling to running speed, and stepless speed control over the running range. Historically, these requirements have been met on d.c. with compound wound motors plus a small motor with over-running clutch for inching and crawling, and on a.c. by similar means but with an a.c. commutator motor for running and a small induction machine for slow work. The type of a.c. commutator motor used has a torque-speed characteristic similar to that of a d.c. compound wound machine.

Developments

Recent developments which merit trial for the application being considered include variable voltage conversion equipment and electronic rectification incorporating servoloop control, which permits control down to inching and crawling speeds without separate motors and over-running clutches. In the demonstrations staged, such equipment was compared with conventional designs, the load being arranged to simulate a typical press in respect of torque and inertia.

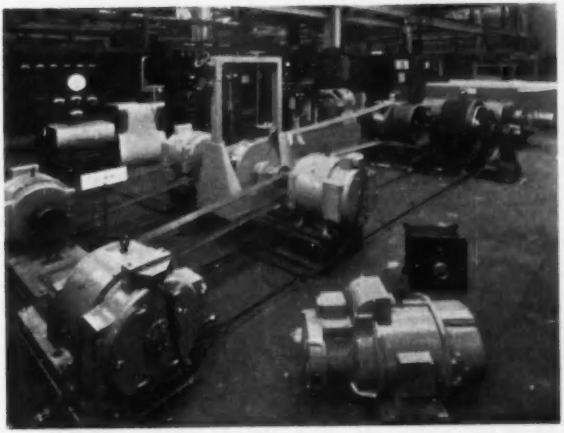
A normal a.c. commutator motor installation was tested first, the speed being controlled by pilot motor operated brush movement, selsyn units keeping in step the brushgear of the two machines involved, and so ensuring good load sharing. Electromagnetic brakes are fitted to give emergency deceleration.

Next come one of the developments, which had involved co-operation with Philips Electrical Co. A 400-V 3-phase a.c. supply is taken to six water-cooled Ignitrons, giving a rectified output of up to 240 kW, or 480 kW if a transformer is added. This output is applied to d.c. motor armatures. Thyratron rectification supplying the fields, and the first half of the speed range depending on armature voltage variation, the second half on field variation. Three thyratron ignition units control the Ignitrons, which are bridge-connected, and an error detector circuit ensures that a constant crawling speed is maintained.

Arc Rectifier Methods

An alternative to this last set-up is to use a 6-phase grid-controlled mercury arc rectifier instead of Ignitrons with a magnetic amplifier replacing thermionic valves in the control circuit. Inching and crawling are obtained by control of rectifier firing, and variable speed between crawling and line speed, and between line speed and top speed, is given by push-button operated induction-type phase shifters.

The mercury arc rectifier is again used in a scheme which has an inching motor and over-running clutch for inching and crawling; the main motor armatures are supplied from the main rectifier, a smaller unit supplying the motor fields and the inching machine armature



Motors and loading apparatus assembled for tests

as well as later in the operation providing field weakening on the main motors. Pilot motor-operated induction-regulator phase shifters provide grid control of the voltage, and the equipment is specially appropriate for use with d.c. duplex driving equipments.

The final demonstration showed a combined a.c. commutator motor and a low-frequency induction motor on the same shaft and in the same carcase. A small low-frequency convertor supplies the induction motor, and both sections combine to give breakaway, inching and crawling; this results in the 3 c/s, l.f. machine torque being superimposed on the a.c. commutator motor torque characteristic, the crawling speed corresponding to the synchronous speed of the induction motor. When crawling speed is to be exceeded the induction machine is disconnected.

Satisfactory performances were obtained from all the designs demonstrated, thus making the choice essentially one of economics, based on existing supply characteristics and motors.

COAL IN 1949

Coal Cleaning and Electrical Power Policy discussed in N.C.B. Report

DURING 1949 230·89 million tons of coal were mined in Great Britain, of which 195·59 million tons were supplied to consumers in this country. The annual report of the National Coal Board for the year, which has just been published (H.M. Stationery Office, 7s.), shows that 30·09 million tons, 15·4% of the total, went to power stations, the B.E.A. thus being the largest single industrial consumer. The Authority took 4·59% more coal than in the preceding year, the overall increase in consumption throughout the country being only 0·99%.

These figures summarise the main statistical interest of the report for the electrical industry, but in its 291 pages there is much further information which is of direct concern both to supply authorities and to equipment manufacturers. For instance there is a discussion of the progress made in revising the price structure, and of the principles on which charges are made. In this repect the factors affecting price differentials are stated to be calorific value, size and special features such as ash friability and fusion point. A step taken during the year was the standardisation of conditions of sale, which included provision for payment on the 15th of the month following despatch. In all these matters consultation with the B.E.A. was continued through regular meetings.

Technical Development

Experiments with mechanised mining marked the year, and promising results were achieved in many cases. Power loading is particularly likely to improve operation, for only 4·4% of the total 1949 output was so handled at the coal face. For haulage purposes the development of locomotives was continued, and of the 331 at work, 52 were electric battery powered.

For mining, as a result of increasing mechanisation, more and more power is becoming necessary. At present the equivalent of some 880 MW is obtained by the direct use of steam, while a further 940 MW is used electrically, about half this being purchased from the B.E.A. By 1955 the electrical demand is likely to rise to 1,300 MW, and a national policy for the supply of electric power to colleries was worked out during 1949. The basis of the scheme is the provision of relatively small colliery power stations, specially designed to burn low quality coal. It is hoped that the B.E.A. will be able to meet deficiencies in power and to accept surpluses, and discussions are proceeding to this end. The size of the stations will preclude shortages of cooling water make-up.

The possibilities of using fluorescent lighting continue to be investigated, and two more installations were made during the year. Three more experimental installations were planned for 1950, one to be on a relatively large scale, involving the lighting of all the coal faces in an underground district.

Clean Coal

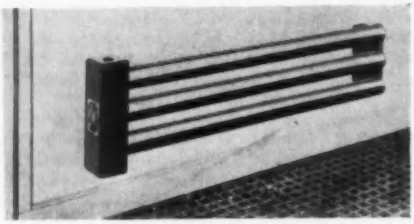
Much has been said by the supply industry about dirty coal, and it is reassuring to read in the report an account of the progress made in coal preparation. The drive for cleanliness begins at the coal face, but at the surface 50% of production is cleaned mechanically and 30% hand picked. Since nationalisation 38 new coal preparation plants had been brought into operation by December, 1949, and a further 27 units were under construction. The total cleaning capacity so represented is nearly 17 million tons/year, and should result in a considerable improvement in quality.

To increase the efficiency of hand picking, research is being carried out into desirable illumination levels and into the effect of lighting with various colours.

The BUYER'S *Column*

Ekco Announce Heavy-duty "Thermotube"

CURRENT release by E. K. COLE, LTD., Southend-on-Sea, Essex, is an industrial and marine waterproof model "Thermotube" heater. It is particularly suited for use in situations where dampness, water spray and rough usage preclude the use of other models. Constructed in heavy gauge seamless steel tubing with welded terminal box fitted with interconnections between tubes, the new "Thermotubes" are available in



The industrial and marine "Thermotube"

lengths from 3 ft to 12 ft. Standard non-ceramic elements, operating at black heat, are used. Normal loading is 180 W per ft for the complete bank but this can be varied as desired between 120/240 W per ft.

A newly developed finish with a top coat of self oak colour cellulose paint, ensuring complete protection from rust, is a special feature.

Installation is facilitated by the large terminal box which allows easy access for wiring—the box being drilled top and bottom for ¾ in. conduits or packed gland, one end is filled with a plug. The cover has a watertight gasket.

Fixing brackets are part of the heater and are arranged for easy fixing to walls or bulkheads. The new "Thermotubes" are available for use on supply mains voltages 100/120, 200/220, 230/250 a.c. or d.c.

Servicing with a Smile

THREE new products are now available from the BRITISH DISTRIBUTING CO., 66 High Street, London, N.8, which will be found very useful by radio service engineers.

A new brand of switch and contact cleaner proved efficient, is supplied in easy-pour cans at 2s. each. A suitable adhesive for jointing metals, fibre, plastics, etc., with a cellulose cement base is priced 1s. per tube, and a non-stretch perfect grip glass-cored nylon-driven cord now available costs 3s. for a 50 ft. card. For manufacturers and other large users reels are available at a reduced price.

All lines are subject to the usual wholesale discounts.

A Lightweight Iron by Hawkins

A RECENT introduction which will be welcomed by housewives is that of the HAWKINS "UNIVERSAL" lightweight electric iron by L. G. HAWKINS & CO. LTD., 30 Drury Lane, W.C.2.

Special features are the "Hand-i-Set" dial for controlling the heat applied to various fabrics, the bevelled edge of the oversize hard soleplate with rounded, wrinkle-proof heel, the solid one-piece heel rest and the plastic handle with comfortable thumb rest. Rating is 800 watts, for a.c. only. The "Lightweight" is finished in chromium.

Indeed an "Ace"

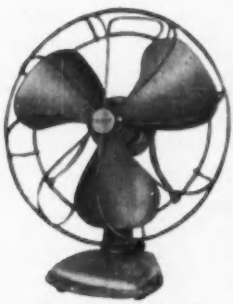
RECENT addition to the range of really low-price electric washing machines is the "Ace Roto-Wash," built by J. ROWELL AND SON LTD., Boyd Street, Newcastle on Tyne 2.

Of robust construction including a tinned copper tank and a first-quality aluminium alloy agitator and top frame, the "Roto-Wash" is powered by a B.T.H. f.h.p. motor.

Secret of the Roto-Wash's success is the patent agitator which has a powerful action. Dimensions are 20 in. by 20 in. by 30 in., and capacity is 10 lb of washing, quite high for its size. Colour schemes available are all white, all cream, cream and white, cream and green or blue and white, and the price is £23, plus tax.

Freshening News

FROM H. FROST AND CO. LTD., of Walsall, we have received details of the range of domestic fans which they are marketing this year. They are the NF950 non-oscillating 9 in. fan, the NF1250, a 12-in. blade non-oscillating model, and a similar model designed for oscillating, the OF1250.



Desk fan by Frost's

Ratings and air displacement figures are interesting; for the three models the figures are as follows: 9 in., 58 watts, 750 cub. ft. per minute at 2 feet; for the 12-in. non-oscillating model, 65 watts and 2,400 c.f.m. at 6 feet. The oscillating 12-in. model has a similar displacement with a rating of 70 watts.

All models are finished in green and silver enamel with chromium guards and mirror finish blades. A special feature is the simplified separate wall mounting bracket.

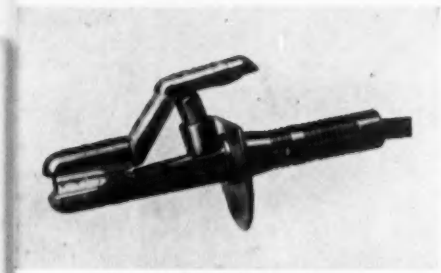
Prices are £3 13s. 4d. plus 18s. 4d. purchase tax, £4 1s. 8d. plus £1 0s. 5d. p.t., and £6 5s. plus £1 11s. 3d. p.t. respectively for the 3 models.

C

The Murex H500 Electrode Holder

THIS new welding electrode holder has been especially designed by MUREX WELDING PROCESSES, LTD., Hertford Road, Waltham Cross, Herts., for heavy duty electric arc welding.

Outstanding features are many. Capacity of the holder is from 100-500 amps and its special long life jaws are grooved to facilitate automatic positioning of all electrodes from No. 8 gauge to ¼ in. diameter. All parts of the holder are replaceable with spares. The holder is assembled or dismantled by the simple Allen key supplied and all live parts are shrouded in special shock-proof insulating material. The light weight of the holder is an unusual feature in a heavy duty model—this holder weighs only 24 oz—and this factor combined with the first-class balance enables operators to work efficiently without fatigue.



New welding holder by Murex

Tape for Sound Recorders

ANNOUNCED recently by the GENERAL ELECTRIC CO, LTD., Magnet House, Kingsway, W.C.2, is a high-grade iron-oxide coated magnetic recording tape suitable for use with most British and Continental machines.

Possessing admirable mechanical and electrical qualities, the tape has an oxide layer 0·0005 in. thick which is controlled within close limits in regard to the size and distribution of the particles. Two grades of tape are available. The first, grade A, is a high coercive force tape; it gives "radio" quality reproduction when run at a speed of 7½in. per second or "dictation" quality at half this speed. Grade B is intended for machines based on German designs. Speed for "radio" quality is twice that of the grade A, and for "studio" quality 30 in. per second.

Width of the tape is 0·25 in. and 0·002 in.-0·004 in. Thickness 0·0025 in. to within 0·0003 in. It is supplied in standard reels, either 250 ft (7 in. diameter) or 1,000 metres (11 in. diameter). Prices and delivery details are available from the company.

TRADE PUBLICATIONS

TIME RECORDING SYSTEMS. Card time recorders are illustrated and detailed in a leaflet, T.1, issued by the Synchromatic Time Recording Co. Ltd., 65 Erskine St., Liverpool 6.

NICKEL-ALUMINIUM-BRONZE CASTINGS. Technical data tends to be rather indigestible unless care is taken in the presentation of such matter. The new booklet issued by the Mond Nickel Co., Ltd., London, W.1, has a very attractive layout in two colours which makes the booklet very pleasant reading.

P.A. SYSTEM CABLES. The efficiency of connecting cables makes or mars the usefulness of a public address system. First quality cables to avoid troubles are illustrated in Publication 275 by B.I. Callender Cables Ltd., Norfolk Street, London W.C.2.

IRON DUST CORES. Issued by the Plessey Co., Ltd., Ilford, Essex, is a brochure containing details of the iron dust cores produced for radio purposes. Dimensions of standard "Caslite" cores are included.

MARINE PLUGS AND SOCKETS. Details of the range of cast brass accessories for shipboard use are set out in List OH/31/Progress issued by Metway Electrical Industries, Ltd., King Street, Brighton.

BATTERIES. Catalogue No. 5, giving details of "Wovanode" and other heavy-duty batteries, electronic flash accumulators, radio and car batteries, has been issued by Battery Construction Ltd., Bristol Rd., Bridgewater, Somerset.

LIGHTING FITTINGS. An interesting leaflet describing some of the Linolite range of tubular lighting fittings is available from the makers, Linolite Ltd., 158 Bishopsgate, E.C.2.

MOTOR EQUIPMENT, ETC. New catalogues issued by Benton and Stone Ltd., Aston Brook St., Birmingham 6, list the variety of equipment supplied under the name "Enots."

DISTRIBUTION SYSTEMS. Individual metal-clad systems are reviewed in trade literature issued by the General Electric Co. Ltd., of Magnet House, Kingsway, W.C.2.

MOSAIC WALL DIAGRAMS. Diagrams for centralised supervisory stations can be constructed easily by means of the Mosaic system supplied by the Automatic Telephone and Electric Co. Ltd., Strowger Works, Liverpool 2.

FIRE ALARM SYSTEMS. The "Carter-Micro" alarm system is surveyed in a booklet published by Carter and Co. (Nelson) Ltd., Nelson, Lancs.

TIME SWITCHES. Type NZXV time switches for off-peak water heating and industrial applications are described in a brochure issued by Venner Time Switches Ltd., New Malden, Surrey.

THE WEEK

INDUSTRY *in news* COMMERCE

International Electrotechnical Commission

MEETINGS of the Committee of Action and of several technical advisory committees of the International Electrotechnical Commission are being held in Paris from July 10 to 22. The United Kingdom will be represented by fifty delegates appointed by the British Standards Institution, the Electrical Industry Standards Committee of which is the British National Committee of the I.E.C.

The following technical advisory committees will be holding meetings: No. 3, graphical symbols; No. 7, aluminium; No. 12, radio-communication; No. 17, switchgear; No. 23, electrical accessories; No. 24, electric and magnetic magnitudes and units; No. 25, letter symbols and signs; No. 32, fuses; No. 33, capacitors for power systems; No. 34, lamps, lamp caps and holders; No. 35, dry-cell batteries. There will also be a meeting of the Special International Committee on Radio Interference (C.I.S.P.R.). The steam turbines meeting takes place in London on July 6 and 7.

A.E.I. Issue Review

ASSOCIATED Electrical Industries Ltd. have just issued a brochure containing a review of progress during 1949 by the Rt. Hon. Oliver Lyttelton, the chairman of the company. Numerous photographic reproductions illustrate the company's very wide range of products and a diagram illustrates how each £1 of the company's income for 1949 was spent.

No District Heating Grant

MANCHESTER will probably not, after all, be able to build a district heating scheme on the Wythenshawe estate. Both the Ministries of Health and Fuel and Power told a deputation last week that no promise of a Government grant towards the cost of the scheme could be made. It is now unlikely that negotiations will proceed any further.

As we recorded on April 20 (page 661), the main point stressed by the Wythenshawe Estate Committee is that the Government should guarantee the Corporation against loss, as the scheme is in the nature of an experiment. It was in April that the committee announced that differences between the Corporation and B.E.A. had been cleared up.

Since inception the scheme has met with a cold reception from the various Ministries concerned. When first proposed the estimates called for an initial cost of £2½ million with householders paying an average of 5s. a week each. But delay caused by excessively protracted negotiations between the Corporation, the various Ministries and B.E.A. has meant that the initial cost has now risen to over £5 million, and householders would be expected to pay 9s. weekly.

The probable failure of the scheme—which has already cost Manchester ratepayers several thousand pounds in consultants' fees alone—is all the more pitiful because of the high efficiency of the two thermal-electric power stations that would have been built.

Drop in Radio Sales

DOWNWARD seasonal trend of radio sales is reflected by the April R.T.R.A. sales index figure. But, compared with last year, television sales are on a higher level. Radiogram sales continue to be higher than they were last year.

Month	Average Number of Sets Sold per Shop	
	1950	1949
RADIO:		
January	11·94	11·79
February	11·89	8·65
March	10·50	6·26
April	8·91	12·48
TELEVISION:		
January	9·09	5·68
February	7·04	4·79
March	7·32	2·94
April	5·18	4·50

A.M.E.E. Annual Meeting

NEGOTIATIONS which have been going on since vesting day for the setting-up of the joint negotiating machinery for the settlement of terms and conditions of service for senior staff in the electricity supply industry, were reviewed by Mr. C. Cameron Kirby, the retiring president of the Association of Managerial Electrical Executives, at the annual general meeting held at 2 Savoy Hill,

The First Half-Century

A Visit to the Central London Railway

Entering the domed gateway of Woodhouse Park, we pass through the extensive grounds from which the last grapes and strawberries were culled by the engineers of the Central London Railway, 20 acres of which are now covered by their generating station, rolling stock sheds and yards. As we arrived at the repairing shop, one of the six 1,300 i.h.p. Allis engines was being indicated, and with permission we snapshotted them at once.—*From our issue of July 5, 1900.*

STUDIES in LIGHTING

250 Mazda fluorescent fittings, each housing a single 5 ft 80 W lamp have just been installed at Sedbergh School, Yorkshire, by Wallis & Watson, Leeds

Above: For this modern lecture theatre at St. John's Hospital, Lewisham. Atlas decorative lighting fittings were mounted in pairs

W.C.2, on Thursday last. He said that it was hoped that an agreement for the "fourth leg" would be signed without undue delay, and it was anticipated that the A.M.E.E. would have sole representation on the machinery for persons holding appointments in a salary range which extended to £1,500 p.a. or above; below that level the Association would have representation on the negotiating machinery for senior grades jointly with the E.P.E.A. and N.A.L.G.O.

Mr. W. F. Cross, the new President of the Association, emphasised the fact that his appointment was an expression by the Association of their declared policy to represent non-engineers equally with engineers without any fear that the one might dominate the other. Mr. Cross, who is a solicitor with the Central Authority, was concerned with the formation of the Electricity Supply Senior Administrative Staff Association shortly before vesting date, and he expressed the hope that as soon as the agreement for the establishment of the machinery for the senior staff was completed, those non-engineers who had been somewhat uncertain as to what body they should join to secure representation would, where they held an appropriate appointment, join the A.M.E.E. He stressed that the effectiveness of the staff side in these negotiations on terms and conditions of service depended on the degree of support that would be forthcoming from the officials concerned.

A presentation was made to Mr. F. W. Purse, who is giving up his work as assistant honorary secretary of the A.M.E.E. for personal reasons. He is to continue as a trustee of the Association for the time being.

Belfast College arranges new Course

BELFAST College of Technology proposes to hold a course in illuminating engineering during the coming session. The course will prepare students for the City and Guilds technological certificate examination, intermediate grade, to be held in May, 1951. It will be an evening course with one meeting each week.

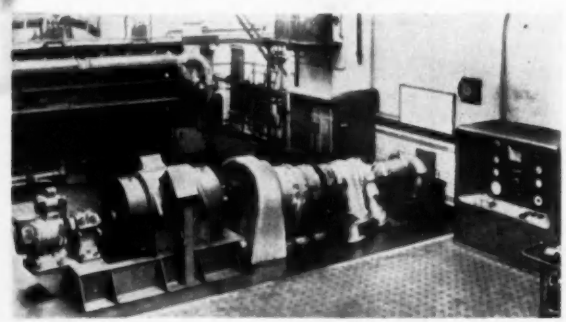
Although full details of times, dates, etc., are not yet fixed, enrolment will take place at the beginning of September. The course will commence towards the end of the same month.

Stourport "B"

IN ORDER to dispel certain misunderstandings which have arisen regarding the article which appeared in our issue for June 22 (p. 1025), we wish to emphasise that the 525 klb/hr main boiler which has the first slag-tap furnace operating in this country, and works at pressures and temperatures exceeding those normally used in power station practice, was designed, manufactured and erected by the Stirling Boiler Co. Ltd.

Alternators for Gas Turbines

WE HAVE now received particulars of the Lancashire Dynamo and Crypto alternator used with the Ruston and Hornsby gas turbine described in our issue of January 19. Continuously rated at 1,000 kW (1,250 kVA) 1,500 r.p.m. 400 V, the alternator is duct-ventilated, with a pedestal bearing arranged for forced lubrication from the turbine oiling system. Particular emphasis is laid on the fact that the alternator is of conventional design. Other electrical equipment includes a Foster step-up transformer and desk type exciter control panel. In addition to this machine, L.D.C. already has in hand the construction of other alternators and motors for gas turbine units by other British manufacturers.



Preference for Irish Contractors?

A RECOMMENDATION that preference be given to Irish contractors was adopted at last week's meeting of Limerick County Council. When it was suggested that the lowest tender received for electrical installation work at the new Regional Hospital be accepted, Mr. D. P. Quish moved that all the tenders be submitted to the Department with a recommendation that preference be given to Irish firms.

There was a difference, he said, of about £5,000 between the lowest and the next lowest, but the firm with the lower figure was not exclusively Irish. Native firms employed both Irish capital and Irish labour and should get preference wherever possible.

Supporting the motion, Mr. P. Lillis said that it was the duty of the Council to encourage native enterprise by supporting exclusively Irish firms.

Bakelite's New Laboratories

SOME of the latest developments in plastics research and development were shown to friends of Bakelite Ltd. on a recent visit to the new laboratories at Tyseley, Birmingham. The company has allocated a floor area of more than 35,000 sq ft to a research and development department, one wing of which has now been completed.

Visitors were shown some of the properties of phenolic resins through the medium of infra-red spectroscopic tests in the research department, and in the development department, the latest types of phenolic plywood glues and cements used for sticking the brass cap on to electric lamps. Work is also being carried out on surface coating with such materials as phenolic baking lacquers.

Parents' Day at B.T.H. Willesden

"OPEN days" at factories are nowadays less novel than they used to be, but B.T.H. Willesden can fairly claim to be amongst the pioneers, since it is now 21 years since they held their first annual Apprentice Parents' Day when the works are thrown open to the relatives of serving apprentices, in order that they may judge at first hand their sons' work, environment and prospects.

Parents, guardians and the heads of technical schools attended this function last Saturday and, following a tour of the works with apprentice guides and tea, were addressed by Mr. H. E. Cox (manager, B.T.H. Willesden), Mr. H. L. Satchell (director, B.T.H.), Mr. E. A. Alexander (factory superintendent, Willesden) and Mr. I. H. Child (apprentice supervisor). Winners of the "Easthope" essay competition were announced, the prizewinning subjects ranging from "Coal" to "The Renaissance of the Water Wheel," the Easthope silver medal being won by R. M. Tregear with a paper on "The Future of the Helicopter." The shield, presented annually to the apprentice who in the opinion of his fellows has shown outstanding qualities of leadership, scholarship and sportsmanship, was won by R. A. Holliday.

Mr. Satchell, in his address, pointed out that the B.T.H. took their first trainee in 1899, and the ex-apprentice register now numbered 6,000, including 700 Willesden men; and that all senior positions in the company were filled by men trained within the company.

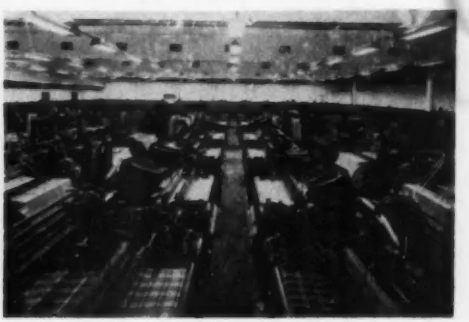
B.E.A. Officials visit Hopkinsons

SENIOR executives of B.E.A., including Lord Citrine, made a short tour of Hopkinson's works at Huddersfield last week. The party included Sir John Hacking (deputy chairman, operation), Dame Caroline Haslett, Lt.-Col. E. H. E. Woodward, Mr. V. A. Pask (chief engineer), and Messrs. H. F. Carpenter, L. J. Luffingham, G. A. Vowles (controller, Yorkshire division), W. H. Dunkley, P. G. Hieatt, C. G. Richards and J. Shillito.

The visitors were met by the chairman and managing director of Hopkinsons Ltd., Mr. R. L. Brown, and were conducted round the works with the object of seeing every stage in the manufacture of valves and boiler mountings from the pattern shop and foundries to the fitting and testing departments.

Some 700 G.E.C. fluorescent fittings are being installed at the Ipswich factory of William Pretty and Sons (1930) Ltd. Most of them are one-lamp trough open top reflectors, each accommodating an Osram 5 ft 80 W lamp. Osram mellow lights the canteen

Metrovick illuminating engineers designed lighting for No. 3 weaving shed at the Chatburn mill of Stonebridge Cotton Manufacturing Co. Ltd. Five foot fluorescent lamps in standard enamelled steel trough reflectors are arranged in eleven rows of six units



Mr. W. W. Vinsen, director of manufacture, B.T.H., welcomes the visitors at lunch at Coton House

Mr. S. R. Eade, manager, Rugby Lamp Works, explains one of the processes to a group of lady visitors

Engineers saw B.T.H. Works

AS PART of their Birmingham summer meeting, some 150 members of the Institution of Mechanical Engineers visited the main B.T.H. works. The gentlemen of the party toured some of the factories devoted to the manufacture of heavy plant, whilst the ladies saw the lamp factory and inspected the many intricate and fascinating stages in the manufacture of Mazda lamps, millions of which are made each year at Rugby. The visitors were also entertained to lunch at Coton House as guests of the company.

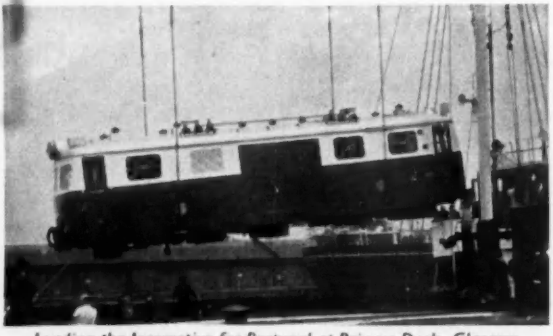
Sir Henry philosophises . . .

SIR HENRY SELF was the chief guest at the Battiwallahs luncheon on Wednesday of last week, and members had the pleasure of listening to him speak on "The Seven Ages of Science." Commencing with the Chinese philosophers, Sir Henry put the first stage as the belief in the uniformity of nature. The second stage was the Indian "khama" or philosophy of "as ye sow, so shall ye reap."

Technology began with the astrologer, the embalmer and the miner, and further progress came with a transition from pure to applied science, Archimedes being instanced as one of the first to apply science to warfare. In tracing the development down to modern times, Sir Henry laid particular stress on three glorious centuries, the 16th, 17th and 18th, during which the practice of experiment to verify philosophy gradually developed, Gilbert being instanced as an example. He wound up his discourse with a quotation from one of the earliest philosophers—Lao Tze: "Govern a great country as you would cook a little fish."

Locos for Portugal

OUR accompanying illustration shows the 960 h.p. 1,500 V mixed traffic electric locomotive included in the order for rolling stock placed with the General Electric Co. Ltd., by the Estoril Railway, Portugal, being shipped to Lisbon, together with the last two trailer coaches for the multiple-unit trains supplied by the company. These deliveries complete the first order for electric rolling stock ever placed with a British manufacturer by any of the Portuguese railways. The electric locomotive is carried on two two-axle motor bogies, each with two 750 V force-ventilated, axle-hung traction motors, providing a maximum speed of 50 m.p.h. Six economical running speeds are available, the electro-pneumatic control equipment being arranged for series and series-parallel connection of the motors, with two weak-field steps in each combination. The mechanical parts have been built by the North British Locomotive Co. The loco has been designed for hauling passenger trains of 300 tons or goods trains of 600 tons.



Loading the locomotive for Portugal at Princes Dock, Glasgow

Economics of Supply

IN OUR report of the discussion on Sir Henry Self's paper at the B.E.P.C., we quoted Mr. J. Eccles (Merseyside and N. Wales E.B.) as saying that the Board's calculations showed that the price unit sent out would rise by 30% in the next ten years. This figure should have been 12½%.

G.E.C. Championship Sports & Gala

IDEAL weather favoured the General Electric Co. Ltd., who held the Silver Jubilee of its annual athletic meeting on Saturday last, the keenly contested events resulting in some new records. The "A. H. Railing" challenge cup for the 880 yards flat scratch (males) was won by J. Hovell (London) in the new record time of 1 min. 58·8 secs., while the winner of the "Lady Railing" challenge cup for the 100 yards flat scratch (ladies) was Miss A. Stanley in 12·1 secs.—a record for the event. A further ground record of 6 ft 1¼ in. in the high jump was set up by J. A. Aladi (Osram) in winning the "Railing" challenge cup in the London championship. The "Leslie Gamage" trophy for the leading London establishment was won by Head Office with 49 points, Osram, with 18 points, being second. In addition to the usual athletics, there were balloon races and children's events, while the side shows and a children's corner were again extremely popular. At the conclusion Lady Railing, O.B.E., presented the challenge cups and prizes to the winners; and this was followed by dancing on the green and, later, a dance in Hirst Hall.

British Engineers' 1950 Handbook

THE 1950 edition of the British Engineers' Association classified handbook has now been published. Comprising in all some 655 pages, it records the members of the Association, with their addresses, branches and overseas agents, and includes a classified list of their manufactures. This, the 21st edition, is being sent gratis to overseas buyers and agents in 115 countries, including a special distribution to Canada and the U.S.A.

Lady Railing, O.B.E., presents the "Heather" Challenge Cup for the 100 yards scratch London championship, to Mr. C. S. Griffen

Result of Hoover Display Contest

RESULTS of the record 1950 Hoover spring window display contest have just been announced. The best Hoover cleaner display in all Britain has been adjudged that of Selfridges Ltd., London. The entry wins a national cup and 100 guineas.

Staged during six busy weeks of the spring cleaning season, competition in the Hoover contest was in three retailer groups: (1) Electricity Board showrooms; (2) department stores and furnishers; (3) electrical contractors and ironmongers, and was organised both on a national basis and also as regional contests throughout the country. A record entry competed for 39 cash group awards from 50 guineas downwards.

National winners in the three main groups were as follows:—

ELECTRICITY BOARDS: 1, N.W. Board, Clarendon Place, Hyde, Cheshire; 2, Eastern Board, 87 George Street, Luton; 3, N.W. Board, Flixton Road, Urmston, Lancs.

DEPARTMENT STORES AND FURNISHERS: 1, Selfridges Ltd., Oxford Street, W.1; 2, T. J. Hughes and Co., Ltd., London Road, Liverpool; 3, Allansons Stores, Ltd., Grange Road, Birkenhead.

ELECTRICAL CONTRACTORS AND IRONMONGERS: 1, Moulds, Ltd., Leatherhead; 2, Lyles Radio and Electrical Engineers, 8 South Street, Tarring, Worthing; 3, A. G. Egginton & Son, Ltd., 83 Washway Road, Sale, Manchester.

Winners in the Hoover competition: Top: Selfridges. Left: N. Western Board showroom at Hyde, Cheshire. Right: Moulds of Leatherhead

NEWS IN BRIEF

Because of the enormous demand, the British Welding Research Association has reprinted publication T.22, *Memorandum on Faults in Arc Welds in Mild and Low Alloy Steels*, first published in *Welding Research*, Volume 4, No. 1, February, 1950. Copies are 2s. 6d. each.

Staff of Philips Electrical Industries Ltd., have contributed £80 towards the fund set up by the Lord Mayor as thanksgiving for wartime food parcels.

Attempting to cash in on Britain's recent hot spell, N.W. Board distributed news sheets to each of its 90 centres. Theme was that electrical appliances—especially water heaters, cookers and refrigerators—make living more comfortable in hot weather.

Plastic coins used as halfpennies by British troops in Germany were found to be in short supply. Reason was that German engineers found they were cheaper than insulators for electrical and radio equipment!

Sixteen members of the I.E.E. students sections are currently touring Dutch engineering projects and factories. On Tuesday a reception was held in their honour by members of the Council of the Koninklijk Instituut Van Ingenieurs and the Electro-Technical Section at the Institution in The Hague.

Yorkshire Board has just published an informative booklet outlining the Board's administrative organisation. A description of present industrial development in the area is supplemented by helpful data about modern trends in supply. An easy-to-read graph shows that the cost of electricity in the area has risen only slightly compared with coal and industrial manufacturers.

Harlow Development Corporation is inviting tenders (by September 30) for the leases of the first twenty shops to be erected at the Stow, Mark Hall. The trades include "Electrical appliances" and "Radio."

Questions in Parliament

Capital Cuts

Mr. P. Donner asked the Minister of Fuel and Power by what amount reductions had been made in the capital available to the electricity supply industry in the current financial year, and what percentage this cut constituted. He replied that an investment programme was approved for the calendar year. The amount originally sanctioned for electricity supply in 1950 was £113 million, but after devaluation, it was decided to reduce the rate of expenditure to £102 million a year. As this reduction could not be made immediately effective, the Minister said he regretted that it was not yet possible to say what the actual saving in 1950 might be.

London Railways

The Minister of Transport was asked whether he intended making a statement on the 1949 Working Party's Report on London Railways; whether he was prepared to accept the recommendation of the report in general; and whether he was prepared to accept the proposal for the electrification of the Chingford and Enfield Town lines from Liverpool Street Station. Mr. Barnes said the recommendations of the report mainly related to long-term improvements which could only be carried out gradually. They must be carefully considered and properly related to other aspects of planning. It was therefore impracticable to say at this stage to what extent the proposals would be adopted, and he could not make any general statement. In regard to the proposal to electrify the Chingford and Enfield Town lines, he was in consultation with the British Transport Commission and hoped to discuss the matter in due course with the representatives of the areas concerned.

Disposal of Reserve Funds

Asked about the disposal of reserve funds of former municipal electricity undertakings in South-East Scotland, the Minister of Fuel and Power said that the B.E.A. had now replied to the consultative council's representations. The Authority had also sent him their comments on the representations. Both these documents were now under consideration.

Board's H.Q.

Replying to a question by Mr. Nabarro, the Minister of Fuel and Power stated that a licence had been issued for work costing £59,000 for the extension of the headquarters of the Midlands Electricity Board at Mucklows Hill. The B.E.A. estimate the work will require 139 tons of steel, 5·1 standards of timber, 410,000 bricks and 245 tons of cement. In the interests of administrative economy and efficiency, officers who were scattered in 27 different places were being housed.

N. Wales Scheme

The model, photographs and diagrams of the North Wales hydro-electric scheme would take up more space than was available in the Library of the House. Arrangements were, therefore, being made for them to be shown in Westminster Hall from Monday of next week for a week, stated Mr. Noel-Baker earlier this week.

Crofter Supplies

Replying to a question by Lord Malcom Douglas-Hamilton, Mr. McNeil said the North of Scotland Hydro-Electric Broad at present supplied industrial consumers in the seven crofter counties at the rate of 12 million units annually, and no industrial undertaking was held up or operating short of power.

Cases in Court

Money Taken from Meters?

OF some interest to the supply industry is the decision of the Eastbourne Watch Committee to take to a higher court the case of the householder who took money from electricity and gas meters. As reported in our May 25 issue, Mrs. J. E. Parker pleaded guilty to larceny, admitting taking £2 10s. from the gas meter, but the magistrates dismissed the charge, considering the accused had no case to answer. Reporting to the Watch Committee last week, Mr. F. Busby, Town Clerk, said the magistrates apparently considered that money in the meters belonged to the woman's husband until collected, and that, as a wife could not normally commit larceny against her husband's property, no offence had been committed.

After taking counsel's opinion, the Town Clerk has applied to the magistrates on behalf of the chief constable, for a case to be stated for the opinion of the Divisional Court of the King's Bench Division.

Right to Use of Water

THE use of some 3¾ million gallons of water a day, from an artificial water course between Beddington sewage farm and the River Wandle, for cooling purposes at the new Croydon power station, is the subject of an action before the King's Bench Division. The British Electricity Authority and Croydon Corporation are being sued by New Merton Board Mills, Ltd. and John S. Deed and Sons, Ltd., who seek a declaration that they are entitled to the uninterrupted use of the water, and claim injunctions restraining either the B.E.A. or the Corporation from diverting or interfering with their use of it. The plaintiffs contend that they acquired a right to the uninterrupted use and enjoyment of the water by prescription, and that the proposed action of the B.E.A. and the corporation contravenes the River Wandle Protection Act of 1908. The defence is a denial that plaintiffs acquired a right to the use of the water or that the defendants are contravening the 1908 Act.

For the plaintiffs, it was stated that Deed and Sons, Ltd., leather manufacturers, on the bank of the river, had been freeholders of the property since 1914 and leaseholders since 1884. Certain amounts of water were required for some of their processing work and they also relied on water as a source of power. For these purposes there was little enough water in the river already. Similarly, for the New Merton Mills, Ltd., cardboard manufacturers, water was essential for the continuation of their industry. They became freeholders of the site in 1926, and it had been the site of a mill since the time of Domesday.

Both plaintiffs were members of the River Wandle Protection Association—and the plaintiffs had been selected as typical representatives. The question to be settled was whether or not defendants had the right to divert the effluent from the artificial water course to the new power station. This depended on whether or not the course was temporary or permanent and upon the general character of the circumstances in which the plaintiffs had actually used the effluent.

It was stated that the effluent from Beddington sewage farm in dry weather formed as much as 70% of the river flow. In correspondence with plaintiffs, the defendants had said that the station would take 3¾ million gallons a day, returning 1¼ million gallons.

Asked about the possibility of an alternative source of supply for the cooling water, Mr. J. Kennard, consulting engineer, said that a suggestion to pump water from the Thames direct to Croydon might be considered.

Mr. F. N. Rendell Baker, consulting engineer for the construction scheme and power station and formerly chief electrical engineer to Croydon Corporation, said an agreement was made between the Corporation and the C.E.B. in March, 1942, for the effluent to be supplied free of charge. There was no practical alternative supply of water for a station on that site. The project had been designed to use sewage effluent, and, if the supply were not available, the effect would be to shut down the station.

Presenting the case for the B.E.A., Mr. Redmond-Barry said that the power station was designed and built on the basis that the effluent would be available. Any suggestion that the water could be obtained elsewhere was inconceivable at the present time. Alterations now would involve heavy expense and endless delay.

Judgment was reserved.

Claim for Loss of Salary and Pension

IN the appeal by the South-West Scotland Electricity Board against the recent judgment (ELECTRICAL TIMES, April 13) by which the Board were ordered to pay £52,408 to Mr. J. Paterson, formerly general manager of the Clyde Valley Electrical Power Co., heard in the Court of Session, Edinburgh, last Thursday, it was argued that the award had been based on erroneous calculations.

For the Board, Mr. A. Thomson said he thought that in awarding the sum claimed, Lord Birnam had based his decision on erroneous calculations—they should have awarded £34,782. The calculation should have been based upon a salary of £4,500 p.a., and not £6,000, and a pension of £2,250, and not £3,000. Also the premium which Mr. Paterson would have required to pay in the 5¾ years which his contract had still to run—and without which he would have had no pension at all—should be deducted from the total amount. The premiums already paid should also be deducted. The total amount that should be deducted under those headings was £4,524. Counsel said it was not agreed that the trustees of the superannuation fund were under an obligation to pay back premiums.

Judgment was reserved.

Electric Supply News

Belfast

The Northern Ireland Ministry of Commerce has sanctioned the obtaining of a loan of £422,300 by the Belfast Corporation Electricity Committee for extensions in the city distribution system.

Fraserburgh

The Housing Committee recently considered a letter from the North of Scotland Hydro-Electric Board regarding the provision of electricity supplies in a new housing area. The Board pointed out that if the houses were wired only for lighting, with one or two heating plugs, the return on capital expenditure would be insufficient. The Board proposed that the Council should either make a contribution towards the mains and services to be installed by the Board or to install, themselves, and then hand them over free of charge to the Board. If electric cookers and washboilers were installed, no contribution by the T.C. would be necessary. The Committee decided to oppose the suggestions, believing that all tenants should be given freedom of choice of electricity or gas for cooking.

Hornchurch

The council has approved a B.E.A. plan for the development of land at Wennington for a generating station.

Isle of Man

The Electricity Board's new diesel generating station at Peel has commenced operations.

Islington

The first section of voltage change-over work in the borough was completed last week, and it is now proposed to proceed with a further stage. The London Board has already made application to the Minister of Fuel and Power for consent to the change of pressure from a.c. single-phase, 100 V, 200 V and 400 V, to 240/415 V. It is estimated that approximately 5,000 consumers are affected.

New E.H.V. Line

B. I. Callenders Construction Co. have now commenced work on the 275 kV Newark-Staythorpe line. Work on tower foundations commenced on June 18, and the erection of the first tower superstructure began on July 5 for completion on Friday, July 7. Foundations for the first nine towers have been completed.

North of Scotland

As we go to press, the North of Scotland Hydro-Electric Board has issued its report for 1949, which covers the first full year's working since its area was extended by the 1947 Act. Gross profit for the year was £96,815, from which the accumulated loss of £74,345 brought forward from 1948 has been deducted, leaving a surplus of £22,470 carried forward. Although supplies were given to a further 62 villages and hamlets, the Board has had to reduce the rate of development of distribution. Fuller details of the report will be given next week.

Power Station Extensions

British Electricity have now received the consent of the Minister of Fuel and Power to the development of four new power stations to their full capacity. The stations are East Yelland, near Barnstaple, Connah's Quay in Flint, Acton Lane, Willesden, and Brighton "B." The Minister's consent has already been given for the initial installations of plant in these stations which, with the exception of Brighton "B," will each have a total installed capacity of 180 MW when completed, made up of six turbo-alternator sets of 30 MW. The total installed capacity of Brighton "B" station when completed will be 330 MW, made up of four 52 MW turbo-alternator sets and two 60 MW sets. The further construction work now sanctioned will be spread over a number of years, no dates having yet been fixed for the completion of the stations.

LIGHTING SCHEMES

Bedworth.—The U.D.C. has authorised the surveyor to proceed with a proposal for a new lighting scheme, at an estimated cost of £12,180.

Chesterfield.—The Ministry of Transport has approved a scheme involving the conversion of 1,620 gas lamps to electricity.

Guildford.—The borough surveyor is to obtain estimates for the provision of fluorescent lighting in Woodbridge Road, as an alternative to mercury vapour.

Richmond (Surrey).—As part of the borough's diamond jubilee celebrations the South Eastern Electricity Board has offered to floodlight without charge the river frontage of the town hall, Kew parish church and St. Matthias Church on Richmond Hill.

Shoreditch.—The Council has approved a recommendation to install time switches on the whole street lighting installation, at an estimated cost of £9,000.

Silloth (Cumberland).—The parish council has approved in principle a proposal for converting its street lighting from gas to electricity. The matter has been referred to Wigton R.D.C.

Stirling.—The T.C. is to investigate the possibility of obtaining mobile generators and searchlights from Scottish Command for floodlighting the castle and the Wallace Monument. They decided against other schemes proposed for floodlighting the castle and monument because of the cost, which, the South-East Scotland Electricity Board stated, would be about £4,645 and £4,130 respectively.

Tipton.—The Council propose to accept the quotation of the Midlands Electricity Board for the installation of electric lighting equipment on various main traffic roads, subject to a loan consent to borrow £20,750.

Company Activities

Dubilier Condenser Co.

Preliminary details show a net profit for the year to March 31 of £64,194 (*£43,586*), after charging income tax £46,000 (*£47,060*), and profits tax £15,700 (*£17,577*), and crediting over-provision of taxation £15,887 (*£16,754*). Ordinary dividend 20% (*same*), to general reserve £50,898 (*nil*), leaving £82,620 (*83,291*) carried forward. The directors propose a free share bonus of three 1s. Ordinary shares for every five held.

Scottish Cables Ltd.

Preliminary details show a trading profit for the year to April 30 last, of £273,901 (*£254,060*). To profits tax and income tax £134,046 (*£125,085*), depreciation and audit fee £24,506 (*£24,153*), leaving balance of £115,355 (*£104,822*). Dividends absorb £46,200 (*same*), to general reserve £65,000 (*£76,058*), leaving £21,730 carried forward.

Tilling-Stevens Ltd.

For the year to March 31, there was a group loss of £31,027 (*profit £57,352*), after taxation £48,647 for the previous year. There is no Ordinary dividend (7½%). The directors state that output for the home market has been adversely affected by compulsory restrictions due to Government policy, while difficulties had been experienced in increasing the export trade, due to intensified competition and the closing of certain overseas markets.

Walsall Conduits Ltd.

Consolidated trading balance for 1949 was £346,508 (*£372,034*), plus interest £2,795 (*same*), making £349,303 (*£374,829*). To depreciation £13,993 (*£12,499*), directors' remuneration £24,006 (*£29,650*), taxation £163,723 (*£154,639*), leaving balance £147,581 (*£178,041*). With £305,879 (*£210,055*) brought in, there is £453,460 (*£389,129*) available. To general reserve £20,000 (*same*), Preference dividends £5,500 (*same*), Ordinary interim 20% and final 35% plus bonus 15%, (*all same*), £57,750, leaving £370,210 carried forward.

Ward and Goldstone Ltd.

After deducting all trading charges, profit for the year to March 31 was £363,581 (*£283,975*), plus transfer from deferred repairs reserve £1,435 (*£6,700*) and profit on sale of fixed assets £124 (*nil*), making £365,140 (*£340,675*). To employees' provident fund £2,000 (*same*), directors' fees £600 (*same*), directors' salaries and bonus £27,335 (*£27,091*), audit fee £788 (*same*), depreciation of fixed assets £39,003 (*£37,193*), income tax £83,159 (*£131,845*), reserve for future taxation £30,000 (*nil*), Profits tax £39,089 (*£32,308*), leaving net profit £143,166 (*£108,080*). With £198,656 (*£299,607*) brought in, there is £341,822 (*£407,687*) available. To Preference dividend £3,080, interim Ordinary £10,380, final Ordinary 24% £15,568 (*all same*), to general reserve £213,575 (*£180,000*), off good will £1,500 (*nil*), leaving £97,719, (*£198,656*) carried forward.

Dividends Declared

E. K. Cole Ltd. Final dividend of 12% making 20% (*30% for previous 18 months*). Net profit £100,681 (*£92,600*).

Hackbridge and Hewittic Electric Co. Final dividend 11% (8½%), making 15% (12½%). After providing £158,000 (*£92,250*) for U.K. taxation, group profit was £135,016 (*£74,310*).

J. and E. Hall. Interim of 2½% (*same*).

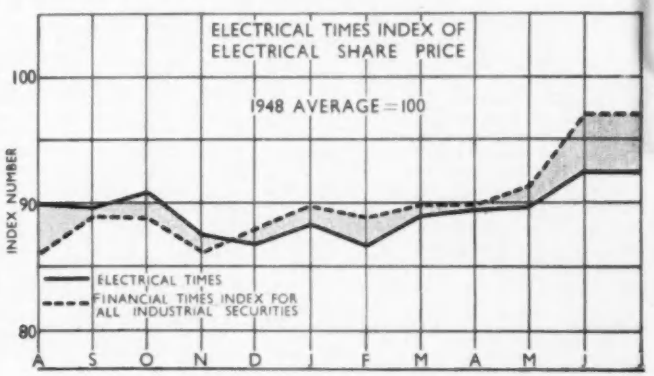
Hick, Hargreaves and Co. Final dividend 8%, making 10% (*same*). Profit, after all charges, including taxation £129,481 (*£123,817*).

Johnson Matthey and Co. Final dividend 9%, making 12% (*same*). Group profit, after all charges including tax, £897,366 (*£260,380*).

Oldham & Son. Final Ordinary dividend of 10%, making 25%, for ten months on capital increased by 100% bonus issue. Profit, before tax, £210,161 (*£244,971 for previous year*).

Walsall Conduits Ltd. Final dividend 35% and bonus 15%, making 70% (*same*). Group trading profit £311,304 (*£332,680*).

Although there was some individual movement of the quoted share prices of the nineteen electrical companies selected for our index, the figure for July 1 remained the same as that of a month ago. So did the "Financial Times" index figure calculated on the same basis. Actual figures were 92.6% of the 1948 average for our index and 96.8% for the "Financial Times" index.



Commercial Information

CONTRACTS OPEN

HOME

July 6.—Ipswich T.C. Electric lighting and heating installation at 14 Museum Street, for T.C. Borough Engineer and Surveyor, 19 Tower Street, Ipswich. Deposit £1 1s.

July 7.—Sheffield T.C. Electrical installations to 198 houses on Parson Cross estate, part 2. Town Clerk, Town Hall, Sheffield 1. Deposit £1.

July 8.—Ashton-in-Makerfield U.D.C. Supply of materials for electrical installation in 62 houses on Bryn Station site. Surveyor, Town Hall, Ashton-in-Makerfield.

July 8.—Birmingham C.C. Supply and erection of two electrically driven hydraulic pumps at the refuse disposal and salvage works at Rotton Park Street, Ladywood. W. H. Andrews, General Manager, Civic Centre, Birmingham. Deposit £1 1s.

July 8.—Ennerdale R.D.C. Electric wiring of 310 houses. Engineer's Office, Council Chambers, Cleator, Cumberland.

July 8.—Mallow. Electrification of creamery premises at Mourne Abbey for Mourne Abbey Co-operative Creamery Ltd. Contract includes wiring for light and power and supply of motors and control gear. Creamery Offices, Mourne Abbey, Mallow, Co. Cork.

July 8.—Newburn U.D.C. Electrical installations for 84 houses at Mount Pleasant estate, Throckley. J. A. Weatherley, Surveyor and Architect, Council Offices, Newburn, Northumberland.

July 10.—Frimley and Camberley U.D.C. Supply, erection and putting into service 102 tungsten filament street lamps. Engineer and Surveyor, Municipal Buildings, Camberley. (See our June 15 issue.)

July 12.—Broughty Ferry. Electrical work for erection of two blocks of semi-detached bungalows and one semi-detached two-storey block at Barnhill for Scottish Veterans' Garden City Association. Architects, Maclaren, Soutar and Salmond, 15 South Tay Street, Dundee.

July 15.—Stretford T.C. New street lighting installation of horizontal mercury lamps for 750 yds of twin-carriageway road. Supply of 1,550 yds of three-core cable. A. H. Perry, Borough Engineer and Surveyor, Town Hall, Stretford.

July 17.—Lamesley. Provision and erection of 30 single arm and 7 double arm steel columns with 44 sodium vapour electric discharge lanterns, lamps and auxiliary equipment for lighting Great North Road between Eighton Lodge and southern boundary of Gateshead borough. J. Neville, Clerk to the Council, 16 Chambers Crescent, Eighton Banks, Gateshead-on-Tyne 9.

July 17.—Surrey C.C. Erection of 13 pre-cast reinforced concrete columns with 23 ft mounting height; lanterns, 400 W, 4 p.m.v. lamps; and electrical equipment as Class A street lighting for roundabout S.W. of Staines Bridge. Fourteen similar columns for roundabout at Egham (junction of Egham bypass with Glanty-Old Windsor road). County Engineer, Highways and Bridges Dept., County Hall, Kingston-on-Thames, Surrey.

July 17.—Waterford C.C. Electrical services comprising lighting, cooking, laundry, sterilising and associated hospital equipment at Arkdeen Sanatorium. Fourteen major buildings, covering 20 acres. Engineer, N. Matthews, 104 Grafton St., Dublin. Deposit £15 15s.

July 19.—Omagh. Additional electrical installations at Omagh Academy and Technical Schools. A. Gibson, Chief Education Officer, Education Offices, Omagh.

July 21.—Hawick T.C. Electrical installation for 40 houses on Burnfoot and Burnhead housing scheme. Burgh Surveyor, Municipal Buildings, Hawick.

July 21.—Sowerby Bridge U.D.C. Fifty-six 3-lamp fluorescent street lanterns complete with chokes, correction capacitators, starter gear and fluorescent lamps, together with 36 columns of approved design. A. Womersley, Clerk of the Council, 23 Wharf Street, Sowerby Bridge.

July 24.—Bootle. Manufacture and erection of pumping plant in Hapsford Road Pumping Station, including two sets of electrically driven unchokeable pumps, each capable of 1,000 gallons per minute, for Rimrose Brook Joint Sewerage Board. Engineer to the Board, G. M. C. Taylor, Artillery House, Artillery Row, Westminster, S.W.1. Deposit £5.

July 31.—Thame U.D.C. Two electrically driven vertical spindle borehole type pumps, with ancillary equipment. Engineers: John Taylor and Sons, Artillery House, Artillery Row, Westminster, S.W.1.

Aug. 1.—Bentley-with-Arksey U.D.C. Supply and installation of sodium discharge lighting centrally suspended over road A19 between Don Bridge and Magnet Hotel, by erection of either new span wires or bracket arms. Engineer to the Council, R. N. Penlington, Council Offices, Cooke Street, Bentley, near Doncaster. Deposit £2 2s. Advertised in this issue.

Aug. 1.—Dundee T.C. Two electrically driven centrifugal pumps to deliver 250 g.p.m. at 180 ft total head, coupled to slip ring induction motors of 400/440 V, 3 phase, 50 c/s, complete with ancillary equipment for Clatto pumping station. G. Little, Engineer and Manager, Dundee Corporation Waterworks, 17 City Square, Dundee,

Aug. 12. — Southport T.C. Supply and erection of five sets of electrically driven (automatically operated) axial flow pumps of a total capacity of 31,250 gallons per minute. Borough Engineer, Town Hall, Southport. Deposit £2 2s.

Aug. 30—Dublin. (a) Two (or three) 6-ton electric portal wharf cranes, and (b) two 10-ton electric portal wharf cranes for Dublin Harbour. Engineer's office, Dublin Port and Docks Board, East Wall Road, Dublin. Deposit £5.

No date stated.—Haddington T.C. Electrical installation for 28 houses at Caponflat, de-

velopment No. 2. John A. W. Grant, Architects, 20 St. Andrew Square, Edinburgh.

No date stated.—Chester. Heating, hot-water installations and electrical installations for the following primary schools: Altrincham Sinderland Road, Bebington Heath Road, Crewe Maw Green, Crewe Totty's Hall, Cuddington Chester Road, Ellesmere Port Overpool, Greasby Mill Lane, Macclesfield Broken Cross, Sale Firs Road, Stalybridge Millbrook, Weaverham Forster Avenue. E. Mainwaring Parkes, County Architect, The Castle, Chester. (Applications by July 15.) Deposit £2 2s. for each school.

OVERSEAS

Details of items marked • may be obtained on application to Room 1076, Board of Trade, Thames House, North Millbank, S.W.1, quoting reference.

July 28.—Brisbane. Twenty-four 500 kVA, 3-phase outdoor type transformers; eight 1,000 kVA, 3-phase, outdoor type transformers. Town Clerk, Brisbane City Council, City Hall, Brisbane. B.o.T. (Ref. CRE (IB) 56751/50).*

July 31.—Uganda. L.V. (mineral insulators) cable installation complete with accessories including erection and connecting up of switchgear and motor starters (supplied under separate contract) for Tororo cement works. Kennedy and Donkin, Alliance House, 12 Caxton Street, Westminster, S.W.1. Advertised in this issue.

Aug. 9.—Uruguay. Ordinary monophase meters for 220 V 2,000 meters of 15 amp; direct 3-phase meters of 2 systems wattmeters for 220 V: 2,000 meters of 3 x 10 A, 1,500 meters of 3 x 25 A, 500 meters of 3 x 50 A, 250 meters of 3 x 75 A, 150 meters of 3 x 100 A. Three-phase high precision meters of 2 systems wattmeters with 2 constant current transformers: 50 meters of 200/5 A, 50 meters of 300/4 A, 30 meters of 500/5 A, 30 meters of 750/5 A, 40 meters of 1,000/2,000/5 A. Spare parts. Usinas Electricas y Telefonos del Estado, Montevideo. B.o.T. (Ref. CRE (IB) 57616/50)*.

Oct. 3.—Wellington. Four single phase double-wound transformer units, each 3,333 kVA, 110/6.35 kV, 50 c/s, outdoor type, oil immersed, self cooled and tap changing on load, for Edgecumbe sub-station. New Zealand State H.E. Dept., Wellington. Deposit £100; bond £1,100.

Oct. 10.—Wellington. Two 50,000 kVA 220/66/11 kV transformer banks and spare unit for a substation at Islington. New Zealand State H.E. Dept., Wellington. Deposit £100; bond £5,300. Contract No. 153.

Nov. 21.—Wellington. Supply and delivery of two 30,000 kVA synchronous condensers with direct coupled exciters, starting and excitation equipment and accessories for installation at Islington substation. New Zealand State H.E. Dept., Wellington. Deposit £100; bond £6,000. Contract No. 153.

CONTRACTS PLACED

B.E.A. During the past month contracts placed amount in aggregate to £3,187,217.

Principal contracts include: Barking "C" power station, superstructures for main buildings, and Woolwich power station, circulating water river works, Sir Robert McAlpine and Sons, Ltd.; North Tees power station, coal and ash handling quays, Sir Robert McAlpine and Sons (Newcastle-upon-Tyne), Ltd.; Doncaster power station, structural steelwork, Wright, Anderson and Co., Ltd.; Northampton power station, cooling tower, Film Cooling Towers (1925), Ltd.; Littlebrook "C" power station, Kent, low pressure pipework, Brightside Foundry and Engineering Co., Ltd.; Connah's Quay power station, Flint, pile foundations, Yorkshire Hennibique Contracting Co., Ltd.

Portobello power station, Midlothian, main and auxiliary cables, B.I.C.C., Ltd.; Goldington power station, Bedford, access roads, railway bridge and sidings and preliminary works, Taylor Woodrow Construction, Ltd.; Plymouth "B" power station, administration and auxiliary buildings, John Laing and Son, Ltd.; Carrington power station, near Manchester, 3.3 kV and 415 V switchgear, and Brimsdown sub-station, 132 kv, 90 MVA reactors, English Electric Co., Ltd.; Islington sub-station, site and foundation works, Holloway Brothers (London), Ltd.; and Worthing sub-station, 30 MVA, 132/33 kV transformers and earthing transformers, Johnson and Phillips, Ltd.

L.C.C.—Supply of electric lamps, including tungsten filament, fluorescent and discharge and projector lamps. Siemens Electric Lamps and Supplies Ltd.

Your Queries — Answered

Thermostats, external fitting for water heaters, makers of? T.E.—British Thermostat Co., Ltd., Windmill Road, Sunbury-on-Thames; Otter Controls Ltd., Market St., Buxton. (18326)

"Rotamix" food mixer—suppliers of? E.W.—R. J. White and Sons (Orpington) Ltd., 20 Bromley Hill, Bromley. (18329)

"Collingham" chimes—makers of? E.B.—Frank Harmer and Co., Ltd., Drub, Gomersal, near Leeds. (18334)

"Eeto" elements—makers of? T.E.—Electric Elements Co., Tokenhouse Yard, Bridlesmith Gate, Nottingham. (18339)

"Castell" locks—makers of? W.H.—J. H. Castell, 81 Gower St., W.C.1 (18346)

"Breeza" fan—makers of? T.E.—London Fan and Motor Co., Ltd., 91 Burghley Rd., N.W.5. (18348)

"Atlas" circuit breakers—makers of? H.W.—Chilton Electric Products Ltd., Hungerford, Berks. (18353)

"Cookes" conduit cutters—makers of? W.W.—A. Collier (Brixton) Ltd., 423 Coldharbour Lane, S.W.9. (18357)

"Edu" hair dryer—makers of? E.E.—Siemens Schukert (Gt. Britain) Ltd., Gt. West Road, Brentford. (18363)

The above are selected from questions we have answered this week. If you have a query, send it to us.

ANSWERS WANTED

"Autette" starters—makers of? A.B. (18368)

Cast plaster wall lighting fittings—makers of? E.E. (18370)

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London W.C.2.

Edwin Brooks, Ltd., 9 Alexandria Drive, St. Annes-on-Sea, Lancs. To take over business of an electrical engineer and dealer in radio apparatus carried on at St. Annes-on-Sea, by E. Brooks. Cap.: £2,000. Dirs.: E. Brooks, D. Tolson.

L. J. Field and Co., Ltd., 296 Ley St., Ilford, Essex. Builders, contractors, electricians, etc. Cap.: £500. Dirs.: L. J. Lewis and Florence J. Lewis.

Heath Tildesley and Co., Ltd., 112 Lower Lichfield St., Willenhall, Staffs. General engineers, manufacturers of and dealers in electrical, industrial and household equipment, etc. Cap.: £1,000. Dirs.: D. H. Fowler, L. Tildesley.

M.G. (Colchester) Electric, Ltd., 28 Church St., Colchester. Electrical and refrigeration engineers and retailers, etc., carried on as "M.G. Electrical Co." at Colchester. Cap.: £10,000. Dirs.: S. A. Martin and Mrs. A. R. Martin, C. E. Goldsmith and Mrs. J. M. Goldsmith, S. E. Cawthra and Mrs. E. Cawthra.

Nore Electric Co., Ltd., 41 Alexandra St., Southend-on-Sea. Cap.: £5,000. Dirs.: A. R. Chance, C. L. Story.

Q.F. Lighting Co., Ltd., Western Chambers, Station Approach, Hayes, Middx. Manufacturers of and dealers in dynamos, motors, cables, armatures, lamps, etc. Cap.: £1,000. Dirs.: E. J. Wyborn, B.Sc., A.C.G.I., M.I.E.E., and Mrs. M. Wyborn.

PRICES OF CABLE METALS AND OTHER MATERIALS
(at Tuesday night)

	£ s. d.	New York price
COPPER, electrolytic	186 0 0	£180 0 0
Delivered in 2nd and 3rd month after order	187 10 0	—
Delivered in 4th, 5th and 6th month after order	189 0 0	—
LEAD, good soft pig (foreign)	88 0 0	88 0 0
" " " " "English" quality	89 10 0	—
Delivered in 2nd and 3rd month after order, plus	1 0 0	—
TIN (99-99.75%) (Cash)	610½-612	—
" (3 months)	611-611½	—
ALUMINIUM, commercial purity (del.)	112 0 0	—
ZINC	127 10 0	120 0 0
ARMOURING		
Galv. Steel Wire (0.104 in.)	43 5 0	—
Mild Steel Tape (0.04 in.)	26 0 0	—

TRADE NOTES

Agency.—Ulster Agencies Ltd., 12/14 Gt. George's Street, Belfast, have been appointed distributors of Tilling-Stevens electric motors for Northern Ireland.

Amalgamation.—Mosers, Ltd., and Nettlefold and Sons, Ltd., who have been under the same management for some years, have now decided to amalgamate under the title of Nettlefold and Moser, Ltd., operating from 170-194 Borough High Street, S.E.1. To that address the Nettlefold business at 163 Euston Road, N.W.1, has now been transferred.

Beama Contract Price Adjustment Formulae.—For purposes of calculating variations in: (a) "Rates of Pay," the rate of pay for adult male labour at June 10, 1950, shall be deemed to be 115s.; (b) "Costs of Material," the index figure for Intermediate Products last published by the Board of Trade on June 10 is 282·6 and is the figure for the month of May, 1950.

Changes of Address.—The Swansea depot of Simpson, Baker and Co. Ltd. has moved to Pipe House Wharf.

The Association of Electrical Machinery Traders has moved to more commodious premises at 100 Park Street, Grosvenor Square, W.1. Tel.: Grosvenor 5416.

Lead Price.—The price of good soft pig lead was reduced by £4 to £88 a ton, delivered, as from June 29.

Rhodesian Copper.—Although the U.S. import duty on copper was automatically re-imposed on July 1 when Congress failed to agree on continued suspension, the Rhodesian copper producers have agreed with the Ministry of Supply that for the time being, the first two cents a pound of any increase in the U.S. domestic copper price, after last Saturday, will not be reflected in the U.K. price.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Swaning Electrical Co., Ltd., Petition for winding up presented at High Court of Justice on June 21 by G.E.C. Ltd. Petition to be heard at Royal Courts of Justice on July 10. Creditors or contributories can obtain particulars from Cochrane and Cripwell, 119 Finsbury Pavement, E.C.2.

Neon (Portsmouth) Ltd. Meeting of creditors at the offices of Cartwright Pyke and Co., Lloyds Bank Buildings, Fratton Bridge, Portsmouth, on July 12 at 3 p.m. to nominate (if thought fit) a liquidator and appoint a committee of inspection.

Senior Lighting Co., Ltd., Senior Works, Church Street, Staines. Creditors to send particulars to the liquidator, Mr. A. A. Henley, 19-20 Grosvenor Place, S.W.1, on or before July 21.

Dividends

Frank Murphy of London Ltd., manufacturers of radio sets, 15 Sun Street, Hitchin, Herts. First payment of 2s. per £1 payable today at 4 Charterhouse Square, E.C.1.

Jay-Vee Engineering Products Ltd., dealers in electrical equipment, Wakes Hall, Wakes Colne, near Colchester. First and final payment of 1s. 1d. per £1 paid on July 1 at 17 Museum Street, Ipswich, Suffolk.

First Meetings

White Cooking Equipment Ltd., manufacturers of and dealers in cooking, heating, lighting and ventilating apparatus and fittings, 3 Red Place, Grosvenor Square, W.1. Creditors and contributories meetings on July 7 at 11.30 and 12 a.m. respectively at Room 401, 4th Floor, Inveresk House, 346 Strand, W.C.2.

Voluntary Liquidation

Moss Brothers (Deptford), Ltd., manufacturers of electrical fittings and baby carriages,

112/114 High Street, Deptford, London, S.E.8. At a recent meeting of creditors a statement of affairs submitted disclosed liabilities amounting to £13,712. Assets at book value were put down at £22,870 and were estimated to produce £12,299, but from the latter amount had to be deducted £2,205 for secured and preferential claims, thus leaving net assets of £10,094, or a deficiency as regarded creditors of £3,618.

The company was registered on March 30, 1949, with a nominal capital of £10,000, all of which had been issued for the purpose of taking over as from April 6, 1949, an existing partnership business. The partnership business had been engaged on the manufacture of fluorescent fittings and later began manufacturing baby carriages, dolls prams, folding chairs and wheelbarrows.

The electrical side of the business was disposed of in February last to another concern. No audited accounts had been prepared since the formation of the company but according to approximate figures it appeared that for the period April 6, 1949, to June 16 last the sales amounted to £57,651, with a gross profit of £6,779, but a net loss of £4,649 was sustained.

A unanimous resolution passed confirmed the voluntary liquidation of the company with Mr. A. W. Hunter, of Latham and Co., 185/188 High Holborn, London, W.C., as liquidator. A committee of inspection was appointed.

BANKRUPTCY ACTS

Dividends

Salford. C. J. Baldwin, 212 Barton Road, Stretford. First and final payment of 5s. 5½d. payable on July 11 at Official Receiver's Office, 20 Byrom Street, Manchester.

BUSINESS PROSPECTS

HOME

Aldridge U.D.C. Erection of 14 houses at King's Road, Rushall. Clerk to Council, Council House, Aldridge.

Baldock U.D.C. Erection of 10 houses on Weston Way estate. F. D. Gentle, Clerk of the Council, Council Offices, Baldock.

Bradford T.C. City Architect to prepare plans and estimates for the improvement of the artificial lighting at Belle Vue girls' grammar school and at Grange girls' school.

Brechin T.C. Erection of 24 houses at Drumachlie Park site. Housing Architect, 30 Panmure Street, Brechin.

Cemaes R.D.C. Erection of 19 houses on Parrog Road site. Council's Architects, Howard Williams and Partners, Greystone, Priory Street, Cardigan.

Cuckfield R.D.C. To conclude contracts for provision of electricity at 210 pre-war council houses on 14 different estates.

Dalkeith. Electrical work for two semi-detached bungalows near police station, for Lothian and Peebles Joint Police Committee. County Architect of Midlothian, 32 Palmerston Place, Edinburgh 12.

Derbyshire E.C. Erection of infants' school buildings at Cherry Tree Hill, County Architect, County Offices, St. Mary's Gate.

Hemel Hempstead. Erection of 68 houses on Belswains estate. Borough Engineer's Office, Market Square, Hemel Hempstead.

Kendal T.C. Erection of 34 houses on Hallgarth estate. J. Barnfather, Borough Engineer and Surveyor, Municipal Offices, Lowther Street, Kendal.

Loftus U.D.C. Received M.o.H. sanction to build 46 houses at Liverton Mines.

Maesteg U.D.C. Erection of 64 houses at Turberville site. Evan Davies, Engineer and Surveyor, Council Offices, Talbot Street, Maesteg.

Middlesbrough T.C. To engage consultant to report on electrical installation at Nunthorpe Hall.

Northumberland E.C. Erection of High Farm county primary infants' school. Borough Education Officer, Town Hall, Wallsend.

Norton U.D.C. Erection of 40 houses on Model Farm estate. F. Vaux, Architect, 31 Quay Road, Bridlington.

Pontefract T.C. Erection of 22 houses on Chequerfield estate. Borough Engineer, Municipal Offices, Pontefract.

Salford T.C. Erection of primary school at Summerville Road (400 places). City Engineer's Office, Town Hall, Salford 3.

Sheffield T.C. Erection of Acres Hill junior county school, Sheffield. W. Geo. Davies, City Architect, City Architect's Dept. Town Hall, Sheffield.

Sheffield T.C. Erection of gymnasium and assembly hall at Hurlfield grammar school, Sheffield. Town Clerk, Town Hall, Sheffield 2.

Wakefield T.C. Erection of 100 houses at Eastmoor estate. City Engineer's Office, Room 33, Town Hall, Wakefield.

OVERSEAS

Brazil. Empresa Kampe de Engenharia Ltda., Rua Sao Jose 50, 11º andar, Grupo 1102, Rio de Janeiro, are anxious to represent U.K. manufacturers of electric power plants: (*a*) diesel generating units with complete electrical equipment, (*b*) hydro-electric units, with complete equipment; substations: (*a*) transformers, (*b*) rectifiers for railways' use; and telecommunication equipment (automatic telephone control exchanges with complete accessories).

Portugal. Daun and Bleck, Lda., Rua dos Fanqueiros 268-1º, Lisbon, desire to represent U.K. firms manufacturing v.h.f. direction finders, v.h.f. receivers, v.h.f. transmitters, h.f. receivers, h.f. transmitters, approach radio beacons, omni-directional radio beacons, directional radio beacons, sound recorders (air-to-ground and ground-to-air) transmitting and receiving antennas, emergency generators.

Northern Rhodesia. — Copperbelt Co-operative Society, Ltd., P.O. Box 343, Kitwe, Northern Rhodesia, would be pleased to receive offers from U.K. manufacturers of electrical fittings and radio sets.

Pakistan.—Taqui Butt and Co., P.O.F.C. College, Ferozepore Road, Lahore, are interested in X-ray and electro-medical apparatus and laboratory goods.

Syria. Agricultural Improvement and Trade Co., Homs, seeks agency for 200 radio receiving sets annually. The firm deals in portable sets of five, six, seven and eight tubes, a.c. and d.c., 110-220 V, 50 c/s.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Columbus. 683,156. Class 17. Insulating varnish. A MacNair and Co. Ltd., Dolphin Works, Dolphin Street, Ardwick Green, Manchester 12.

"Globe-King" with design. 682,180. Class 9. Short wave receiving sets. Johnsons (Radio) Macclesfield, 102 Palmerston Street, Bollington, near Macclesfield.

Jet-Vita. 687,450. Class 11. Gas lighter elements. Vitality Bulbs Ltd., Neville House, Neville Place, Wood Green, London N.22.

Phoenix, with design. 683,286. Class 9. Telephonic and signalling apparatus. Phoenix Telephone and Electric Works, Ltd., The Hyde, Hendon, London N.W.9.

MEETINGS TO NOTE

MONDAY, JULY 10

WORLD POWER CONFERENCE.—Technical sessions at the Institutions of Civil, Electrical and Mechanical Engineers. Opening at Central Hall, Westminster.—3 p.m.

TUESDAY, SEPT 5

SCIENTIFIC INSTRUMENT MANUFACTURERS' ASSN.—Annual exhibition and symposium (until Sept. 8). Examination Hall, Queen Square, W.C.1.

LONDON ELECTRIC WIRE COMPANY AND SMITHS

THE forty-first annual general meeting of The London Electric Wire Company and Smiths, Limited, was held on June 28 in London.

Mr. W. J. Terry (chairman and managing director), in the course of his speech, said:—

Current assets standing at £2,716,034, although lower than last year, are more than three times the total of current liabilities and provisions.

During last year, some extensions have been made to our factory buildings to provide further necessary manufacturing accommodation and all buildings have been maintained in good condition.

Substantial additions and renewals have also been made to the company's plant to meet changing requirements and further additions are on order for delivery during the current year. All plant has been kept in good serviceable condition.

I would like to draw attention to light hydrocarbon oils which are extensively used in some of our manufactures. It is difficult to understand why the cost of these supplies should be increased by the imposition of a duty, particularly as they are mainly derived from an indigenous product.

During 1950, however, there has been a marked improvement in orders received.

Taxation

As in previous years I must again refer to the very heavy burden of taxation imposed on industry by the large appropriations from earnings which have to be provided out of liquid resources.

The recent additional levy of 9d. per gallon on petrol must be carried mainly by industry since the amount of petrol used for pleasure motoring is insignificant as compared with the quantities consumed by commercial transport and in manufacturing operations.

The Tucker Committee appointed to report on the method of computing trading profits for taxation purposes has already been referred to in the annual statements of other companies and it is hoped that the outcome of their unstinted efforts will be a simplification in the assessment of taxable profits which should conform as closely as possible to commercial profits.

Our overseas business is still handicapped by import restrictions and currency difficulties and exports to the Dominions have been curtailed owing to the development of local manufacture. In this development we have some interest which we have in mind to extend, although we would naturally prefer to export from home factories.

The nationalised industries have advanced their prices. Manufacturers are not only paying increased prices, but particularly in the case of coal, are receiving supplies of an inferior quality which would have been unsaleable before the war.

It must, however, be admitted that the nationalised industries are working under severe handicaps due to increasing restrictions imposed upon legitimate capital expenditure to enable them to improve and extend their services.

The high quality of your company's products has maintained a world-wide reputation and its financial position as presented by the balance sheet is intrinsically sound—due to our conservative policy of ploughing back profits over many years. The need to plough back profits into business is greater than ever today in order to retain a sound financial position.

The report was adopted.

TELEPHONE MANUFACTURING

THE twentieth annual general meeting of Telephone Manufacturing Co. Ltd., was held on July 3 in London, Mr. Fred T. Jackson, O.B.E., COMP.I.E.E. (the chairman and managing director) presiding.

The following is an extract from his circulated statement for the year ended Dec. 31, 1949 :—

The accounts show another highly successful year of trading and reflect the results of a year of considerable activity. The profit of the parent company amounted to £193,770 as compared with £209,376 for 1948. The group profits amounted to £220,000 as compared with £228,654 for 1948. The turnover fell very little short of the total for 1948, which was a record, apart from the war years. The rate of profit has been maintained although we have had to extend the range of our products to cater for the needs of the export market.

The special attention that we pay to efficiency in operation has made these results possible. Our employees benefit through bonus schemes of one sort or another and I do not think we can be accused of exercising other than moderation and restraint in recommending an increase from 6½% to 7½% in our final dividend.

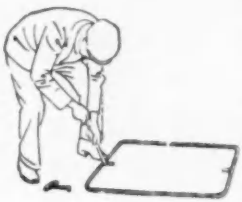
Direct exports constituted 30% of our output and for the first three months of this year this percentage has increased to 67%.

Our long-term prospects are bright, but the immediate future gives causes for some concern. Keener prices and the increased cost of materials arising from devaluation will affect our figures for the current year. However, our trading results so far are very satisfactory and I anticipate that the profits will be sufficient to maintain our dividend and have something in hand for general reserve.

The report was adopted.

Note these features

The unique features embodied in the construction of the 'Holborn' Frame and Cover have ensured its popularity amongst users all over the world.



1. **THE COVER SLIDES** easily into and out of the Frame.
2. **ROUNDED CORNERS** give added strength to resist breakage in transit and handling. Fig. 1.
3. **EASY TO REMOVE**—The inclined section prevents dirt and foreign matter wedging the joint. Fig. 2.
4. **NON-SLIP.** Narrow raised serrated edges, scarcely noticed in made-up pathway, minimise slipping by pedestrians.

FIG. 1

5. **CORRECT POSITIONING** of cover in frame is ensured by special combined location and pinch bar slot.
6. **TESTS FOR STRENGTH.** Larger size pavement frames and covers were proven in successful weight tests of over 3 tons dead load and half a ton rolling load.

FIG. 2

7. **NAME PLATES** available. Loose cast iron plates avoid the necessity of specially cast covers.
8. **WIDE RANGE OF SIZES** to meet all normal requirements.

Ask for Catalogue 28/2

HENLEY

"HOLBORN" PAVEMENT FRAMES AND COVERS

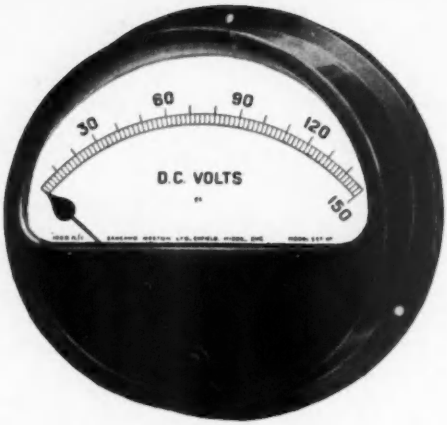
(Covers are supplied without concrete filling.)

W. T. HENLEY'S TELEGRAPH WORKS COMPANY LTD. 51-53 HATTON GARDEN LONDON, E.C.1.

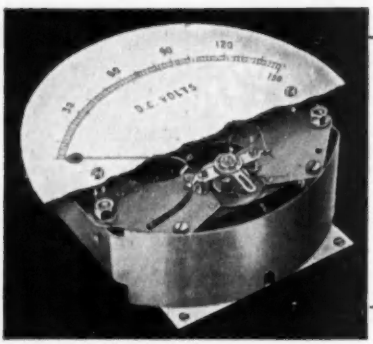
FEATURES OF WESTON SUPERIORITY

Weston

MOVING COIL SWITCHBOARD INSTRUMENTS



Combining the sensitivity of a laboratory instrument with the robust qualities of a switchboard pattern, this new series of 'Weston' permanent-magnet, moving coil instruments represents a great advance in design and technique. They incorporate thermocouples and rectifiers where necessary. Special features include efficient damping, the new standard 'Weston' patented spring-loaded jewel to protect the pivot, magnetic shielding and a high degree of accuracy. Mounted in attractive bakelite cases, flush fitting or projecting, the 6" easily read scale is printed in black on white enamel. All instruments conform to B.S.I. Spec. No. 89. Special enquiries will receive the personal attention of our Technical experts. The model S57 illustrated is supplied as a D.C. Microammeter, Milliammeter, Millivoltmeter, Ammeter and Voltmeter, all with a variety of ranges.



MAGNETIC SHIELDING. To prevent interference from external magnetic fields and to reduce those due to the instrument, it is magnetically shielded as shown. The high degree of accuracy of these instruments is in no small measure due to this 'Weston' design.

SANGAMO WESTON LIMITED

ENFIELD, MIDDLESEX.

Telephone : Enfield 3434 & 1242 - - - Telegrams : Sanwest, Enfield.

Depots at : Glasgow, Newcastle-on-Tyne, Leeds, Manchester, Wolverhampton, Bristol, Liverpool, Nottingham, Southampton, Ipswich and Brighton.

120

CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WANTED · FOR SALE WORK WANTED

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia St., W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 35s. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

TENDERS INVITED

BENTLEY-WITH-ARKSEY URBAN DISTRICT COUNCIL

SUPPLY AND INSTALLATION OF SODIUM DISCHARGE LIGHTING

TENDERS are invited for the supply and installation of sodium discharge lighting centrally suspended over road A19 between the Don Bridge and the Magnet Hotel by the erection of either new span wires or bracket arms.

A copy of the drawings, specification, bill of quantities, and form of tender may be obtained from, and the general conditions of contract inspected at, the offices of the Engineer to the Council, Mr. Robert N. Penlington, A.M.Inst.C.E., at the address below, on the deposit of two guineas, returnable only on the receipt of a bona fide tender and the return of all documents.

Sealed tenders, in envelopes which do not bear any name or mark indicating the name of the sender, and endorsed "Sodium Street Lighting," to reach the undersigned not later than noon of Tuesday, August 1, 1950.

The Council does not bind itself to accept the lowest or any tender.

W. H. CARLILE,
Solicitor and Clerk to the Council.

Council Offices, Cooke Street,
Bentley, near Doncaster. (F 272)

UGANDA CEMENT INDUSTRY

TENDERS are invited for LOW VOLTAGE (MINERAL INSULATED) CABLE INSTALLATION, complete with accessories including erection and connecting up of switchgear and motor starters supplied under separate contracts for the Tororo Cement Works in Uganda.

Tender documents may be obtained from the Engineers, Messrs. Kennedy and Donkin, Alliance House, 12 Caxton Street, Westminster, S.W.1.

Application for Tender documents should quote the reference UG.16-4, and Tenders must be submitted to Messrs. Kennedy and Donkin by twelve o'clock noon on Monday, July 31, 1950.

C. R. WESTLAKE, ESQ., M.I.E.E.
Chairman,
Uganda Cement Industry,
P.O. Box 559,
Kampala,
Uganda.

KENNEDY & DONKIN,
Consulting Engineers,
Alliance House,
12 Caxton Street,
Westminster,
London, S.W.1. (F 268)

APPOINTMENTS VACANT

SOUTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF SURVEYOR

APPLICATIONS are invited for the position of Surveyor in the Board's Central Construction Department with Headquarters at Taunton, Somerset.

Candidates should possess a recognised surveying qualification and have had three years' experience, preferably on o/h line work in the industry.

The duties will include making field surveys and plotting results, and preparing profile drawings and schedules of material for o/h line construction.

The commencing salary, which is provisional pending negotiation of an appropriate salary scale, will be between £350 and £450 p.a., according to qualifications and experience.

Applications, giving age, present appointment and salary, qualifications and experience, to be submitted to the Assistant Secretary (Establishments), South Western Electricity Board, Electricity House, Colston Avenue, Bristol 1, within ten days. (F 292)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

STATION SHIFT CONTROL ENGINEER—DERBY

APPLICATIONS are invited for the position of Station Shift Control Engineer at Derby Generating Station.

Candidates must have had a good general education and technical training, be experienced in the operation and control of all e.h.t. switchgear, and be competent to take charge of the switchboard of a modern generating station. Preference will be given to candidates who hold the higher national certificate in electrical engineering or equivalent qualifications.

The salary will be in accordance with Class "F," Grade 10 of the National Joint Board Schedule, and the appointment will be subject to superannuation under terms and conditions approved by the British Electricity Authority.

Applications should be submitted on the official form of application, which may be obtained from the Divisional Establishments Officer at the under-mentioned address, and be returned not later than July 17, 1950.

W. S. BURGE,
Divisional Controller.

British Electricity House,
Barker Gate, Nottingham.
22.6.50. (F 251)

NORTH WESTERN ELECTRICITY BOARD

No. 7 Sub-Area

APPOINTMENT OF ASSISTANT TO THE STATISTICAL ENGINEER

APPLICATIONS are invited for the appointment of Assistant Engineer in the statistical section of the Technical Engineer's Department at No. 7 Sub-Area Headquarters, Chapel Street, Hazel Grove.

Applicants should hold the Higher National Certificate in Electrical Engineering or an equivalent qualification, and should have a good knowledge of distribution practice.

The duties will include the collection and analysis of technical data relating to an extensive underground and overhead distribution system.

The salary, which is provisional and subject to negotiation with the appropriate body, will be within the range £450-£550 per annum, depending on qualifications and experience.

Applications, stating age, education, training, qualifications, subsequent experience, present position and salary, should be received by the Sub-Area Manager, The North Western Electricity Board, No. 7 (Stockport) Sub-Area, Chapel Street, Hazel Grove, Cheshire, not later than Saturday, July 22, 1950. (F 299)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

JUNIOR ENGINEER

APPLICATIONS are invited for the appointment of a Junior Engineer in the Southport District of No. 1 Sub-Area of the Board.

The salary payable is £375 per annum, in accordance with the revised N.J.B. Schedule, Class "E," Grade 14.

Applicants must have received a thorough technical training and obtained the Higher National Certificate in Electrical Engineering or equivalent qualification and possess some experience in the design, construction, and operation of h.v. networks, sub-stations and m.v. networks up to and including 6·6 kV.

The successful candidate may be required to pass a medical examination and will, if eligible, contribute to a superannuation scheme.

Applications should be made on a form obtainable from the Manager, No. 1 Sub-Area, 24 Hatton Garden, Liverpool, and should be completed and returned to him not later than July 20, 1950.

J. RANKIN,
Secretary. (F 296)

BRITISH ELECTRICITY AUTHORITY

North Eastern Division

APPOINTMENT OF SENIOR ASSISTANT TO THE TRANSMISSION ENGINEER

APPLICATIONS are invited for the appointment of a Senior Assistant Engineer, Transmission Engineer's Department at the Headquarters of the North Eastern Division, Newcastle-upon-Tyne.

Applicants should have received a first-class technical education, and have had considerable experience in the design, layout, erection, and maintenance of high-voltage transmission lines, together with sub-stations and their equipment.

The salary for this appointment will be in accordance with Grade 1, Schedule "C," of the National Joint Board Agreement, £924-£1,076 per annum and commence at a point commensurate with qualifications and experience.

Superannuation will be in accordance with the British Electricity Authority and Area Boards' Superannuation Scheme.

Forms of application may be obtained from the Divisional Secretary (Establishments), British Electricity Authority, North Eastern Division, Carliol House, Newcastle-upon-Tyne 1, to whom they should be returned to arrive not later than Monday, July 17, 1950. (F 277)

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

APPLICATIONS are invited for the appointment of SHIFT CHARGE ENGINEER at the Percival Lane Power Station, Runcorn. Salary £651-£679 per annum, being Class "G," Grade 7, of the N.J.B. Schedule.

Applicants should have had a good general and technical education and experience in the Shift Operation of Generating Plant. The possession of a Higher National Certificate or equivalent qualification would be an advantage.

The appointment will be superannuable under the British Electricity Authority and Area Board's Superannuation Scheme and subject to a medical examination.

Forms of application may be obtained from the Divisional Secretary, British Electricity Authority, Merseyside and North Wales Division, Clarke Gardens, Woolton, Liverpool, and should be returned not later than Saturday, July 22, 1950.

A. R. COOPER,
Divisional Controller.
(F 295)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

SHIFT CHARGE ENGINEER—CHESTERFIELD

APPLICATIONS are invited for the position of Shift Charge Engineer at Chesterfield Generating Station.

Applicants should have a sound technical training and practical experience in the operation and control of steam generating plant and switchgear and preference will be given to candidates who have the Higher National Certificate or equivalent qualifications.

The salary will be in accordance with Class "B," Grade 7 of the National Joint Board Schedule and the post will be superannuable.

Applications should be submitted on the official form, which may be obtained from the Divisional Establishments Officer at the under-mentioned address, and returned to him not later than July 24, 1950.

W. S. BURGE,
Divisional Controller.

British Electricity House,
Barker Gate, Nottingham.
30.6.50. (F 297)

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF INSTALLATION AND APPLIANCE BUYER

APPLICATIONS are invited for the appointment of Installation and Appliance Buyer in the Purchasing Section of the Chief Engineer's Department at Area Board Headquarters, Cheetwood Road, Manchester 8.

The successful candidate will be responsible to the Purchasing Officer for the preparation of contract documents and the conducting of purchasing negotiations with suppliers. Preference will be given to applicants having sales or buying experience covering the range of appliances, wiring accessories, and equipment required by domestic, commercial, and industrial electricity consumers. The possession of a suitable technical qualification will be an advantage.

The provisional salary for the post will be in accordance with the revised National Joint Board Schedule, and within the range of Class "AX.DX," Grade 5, i.e. £579-£776 per annum, subject to negotiation with the appropriate body.

Applications, stating age, qualifications, experience, present post and salary, should be received by the Establishment Officer, The North Western Electricity Board, Cheetwood Road, Manchester 8, not later than Saturday, July 22, 1950. (F 298)

SOUTH EASTERN ELECTRICITY BOARD

Worthing District

DISTRICT SENIOR CLERK

SALARY of £630 by £25 to £705 per annum. N.J.C. Agreement, Grade 6. Superannuation will be arranged. The Worthing District includes Shoreham and Littlehampton. Applicants should have experience in a similar position. A secretarial or accountancy qualification would be an advantage.

Applications, giving two referees, must reach M. J. Mortimer, Esq., M.I.E.E., Worthing Manager, South Eastern Electricity Board, 56 Chapel Road, Worthing, by July 15, 1950.

East Sussex and South West Kent Sub-Area, Eastbourne

SENIOR AUDIT ASSISTANT

Salary £570 by £20 to £630, under the N.J.C. Agreement, Grade 5. Superannuation will be arranged. Applicants must have had experience in the organisation and operation of a complete system of internal audit and should have passed an examination of a recognised accountancy body.

Applications, giving two referees, must reach N. Boydell Esq., M.I.E.E., A.M.I.Mech.E., Manager, East Sussex and South West Kent Sub-Area, "Westlords," Willingdon Road, Eastbourne, by July 15, 1950.

A. L. BURNELL,
Secretary.
June, 1950. (F 294)

BRITISH ELECTRICITY AUTHORITY

South Eastern Division

APPLICATIONS are invited for positions as INSPECTING ENGINEERS (one mechanical, one electrical) at Littlebrook Power Station, near Dartford, Kent.

The successful applicants will be responsible for the inspection of plant before, during, and after maintenance, for assessing the extent of work to be done, and for the preparation of technical reports on defective plant, compiling maintenance records, etc.

Applicants should have had a sound technical education, with practical experience of maintenance of modern generating station plant.

Salaries for these positions will be in accordance with Class "J," Grade 11, of the N.J.B. Schedule, inclusive of London allowance, at present £597 9s. per annum.

Forms of application may be obtained by sending a stamped addressed foolscap envelope to the Divisional Secretary, British Electricity Authority, South Eastern Division, Lower Ham Road, Kingston-on-Thames, and should be returned, completed, together with copies of two recent testimonials, not later than July 19. (F 290)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for the position of INSTRUMENT MECHANIC at Stourport "B" Generating Station. The rate of pay will be in accordance with the N.J.I.C. Schedule, 35d. per hour.

Applicants should have considerable knowledge of the repair and maintenance of all types of instruments used in the control of boilers and turbines. Preference will be given to applicants who have had some experience of Bailey automatic boiler control equipment and "Multelec" instruments.

Applications should be made on forms obtainable from the Divisional Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, and be returned not later than July 22, 1950.

H. N. WILSON,
Divisional Secretary.
(F 276)

YORKSHIRE ELECTRICITY BOARD

No. 6 (Hull) Sub-Area

APPLICATIONS are invited for the following appointments :—

DRAUGHTSMAN (No. 1 (Hull) District) (5 posts—2 Grade I, 1 Grade II, and 2 Grade III). Vacancy No. 34/50.

Applicants must have had experience in architecture, building design and construction, structural steelwork and bills of quantities.

Duties will include, preparation of layouts and working drawings for offices, showrooms and industrial buildings, also alterations to existing buildings.

Provisional salaries: Grade I, £400 by £25 to £500 per ann. Grade II, £360 by £20 to £400 per ann. Grade III, £290 by £20 to £350 per ann.

Applications, stating the above vacancy number, and giving full details of age, qualifications and experience, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Kingston-upon-Hull, within fourteen days of the appearance of this advertisement. (F 293)

HIS MAJESTY'S COLONIAL SERVICE

A VACANCY exists for an ELECTRICAL ENGINEER in the Public Works Department, Gambia Colony.

The appointment is either on contract or permanent and pensionable. If on contract the salary would be in the scale £1,236 to £1,600 per annum. If permanent and pensionable, the salary scale would be £1,030 to £1,300 per annum. In addition a cost-of-living allowance of £60 per annum, plus an allowance of £2 10s. a month for each child up to a maximum of two maintained outside the Colony, point of entry in each case depending on age, qualifications, experience, and war service.

Candidates must be corporate members of the Institution of Electrical Engineers or hold equivalent qualifications or should have passed Sections "A" and "B" of the Institution examination, and should have served an electrical engineering apprenticeship and have a thorough knowledge of generation and distribution. Experience in diesel engines, construction and installation of overhead lines, underground cable network and outdoor and indoor sub-stations, voltage up to 11 kV, and knowledge of radio telephony would be an advantage. The officers selected would be required to take charge of electricity undertakings in the Colony.

Partly furnished quarters at low rentals, and free first-class passages each way each tour for the officer and his wife, if married, are provided. Home leave on full pay at the end of each tour of 18 months at the rate of seven days for each month of resident service Income tax at local rate.

Intending candidates should write for application forms to the Director of Recruitment, Sanctuary Buildings, Great Smith Street, London W.1, giving brief details of age, qualifications, and experience, as soon as possible, quoting the reference number 27326/26. (F 273)

MIDLANDS ELECTRICITY BOARD

North Staffordshire Sub-Area

APPOINTMENT OF DEMONSTRATORS

APPLICATIONS are invited for appointments as Demonstrators in districts of the North Staffordshire Sub-Area.

Applicants must have had a good general education, and the possession of a recognised diploma in domestic science and electrical housecraft will be an advantage. Candidates must be able to conduct lecture demonstrations, both in the showrooms and on consumers' premises, and to advise consumers on the selection and use of electrical apparatus.

Salary and conditions of service will be in accordance with the National Joint Council, Grade 1, within the range £310-£350 per annum, with further progress to £390 per annum, dependent upon a certificate of capability.

The successful applicants will be required to contribute to the Board's Superannuation Scheme if eligible.

Applications, stating age, education, details of training and experience, should be forwarded within 14 days to Mr. H. A. P. Caddell, Sub-Area Manager, Midlands Electricity Board, North Staffs Sub-Area, 31 Kingsway, Stoke-on-Trent.

A. STEPHENS,
Secretary.

June 29, 1950. (F 289)

BRITISH ELECTRICITY AUTHORITY

South Wales Division

APPLICATIONS are invited for the following appointments in this Division at salaries in accordance with the Revised National Joint Board Agreement.

(a) STEAM ENGINEER, DIVISIONAL HEADQUARTERS Class "AX.CX." Grade 3—£737 to £921 per annum. Applicants should have considerable experience of plant erection and operation and should be corporate members of the Institutions of Mechanical or Electrical Engineers.

(b) RECORDS ENGINEER, UPPER BOAT POWER STATION Class "H," Grade 11—£538 to £558 per annum. Applicants should have served a regular apprenticeship, obtained a Higher National Certificate, and had previous experience in work of a similar nature.

The appointments will be superannuable under the British Electricity Authority and Area Boards Scheme.

Forms of application may be obtained from the Divisional Secretary at the address below, to whom completed applications should be returned not later than July 21, 1950, in sealed envelope endorsed with the appointment sought.

H. V. PUGH,
Divisional Controller.

Cardiff (Pengam Moors) Airport,
Cardiff.
June 30, 1950. (F 291)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointment :—

BOILER HOUSE SHIFT CHARGE ENGINEER—Brimsdown "B" Generating Station.

Salary in accordance with the revised N.J.B. Schedule, Grade 9, Class "H" (£609-633 per annum, plus 5 per cent. London Weighting).

Applicants should possess a knowledge of the theory of combustion and have had experience in the operation of large boilers working at high steam pressures and fired with chain grate stokers and pulverised fuel. Some electrical knowledge will be an advantage.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Applications, stating age, experience and present position, should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to arrive not later than July 14, 1950. Envelopes should be endorsed "Boiler House Shift Charge Engineer, Brimsdown."

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, N.14. (F 253)

ALUMINIUM WIRE AND CABLE CO. require two fully qualified ELECTRICAL ENGINEERS with a knowledge of overhead transmission lines for developing and extending the use of aluminium conductors.

Applicants must be prepared to travel abroad if required and should preferably be 35-45 years of age. They would work from the Company's London Sales Office.

Write for application forms to Ministry of Labour and National Service, Technical and Scientific Register (K), York House, Kingsway, London W.C.2, quoting D.181/50-A, which must be returned completed by July 31, 1950.(F 176)

AN interesting opportunity exists for a young and fully qualified ELECTRICAL ENGINEER with knowledge of electronics in connection with servo mechanism development for aircraft.—Write to Mr. G. Orloff, Chief Designer, British Messier, Ltd., Cheltenham Road East, Gloucester. (F 284)

APPLICATIONS are invited for the position of TECHNICAL DESIGN ENGINEER in the F.H.P. Motor Laboratory at a large electrical engineering company in the West London area. Experience of f.h.p. motor design and performance, and ability to accept full responsibility of a project from the initial design stage to factory production is essential. Applicants should possess engineering degree or equivalent qualifications. Salary will be in the region of £600 to £900 per annum, according to qualifications.—Apply, giving details of age, education, and job history, to the Employment Officer, Hoover, Ltd., Perivale, Greenford, Middx. (F 282)

DESIGNER of a.c. and d.c. machinery required by an established firm of motor manufacturers. Applicants should have design experience of generators and alternators, covering outputs up to approx. 250 h.p.—Replies, in confidence, should state age, experience, qualifications, salary expected and be marked "Electrical Designer" and be sent to: Addleshaw, Sons and Latham, Solicitors, 15 Norfolk Street, Manchester 2. (F 300)

DRAUGHTSMAN, O.N.C., age 22-23, used to detailing fractional horse power electric motors, required by well-known manufacturers.—Write in first instance, giving full details of experience, etc., to Croydon Engineering Co., Ltd., Commerce Way, Purley Way, Croydon, Surrey. (F 267)

DRAUGHTSMEN, with knowledge of general electrical design work. Workshop training desirable. Permanent position, with superannuation scheme. Salary according to age and qualifications.—Apply in writing to the Staff Officer, B.I.C.C., Ltd., Prescot, Lancs. (F 274)

ELECTRICAL ENGINEERS required for service in Middle East. Applicants should (a) possess Ordinary or Higher National Certificate and have had full apprenticeship with heavy electrical equipment manufacturers or with a large colliery or allied fully electrified industry, or (b) possess a degree and have had two years' technical apprenticeship with similar firm to above. In each case applicants must have had at least three years' subsequent experience on the installation and maintenance of heavy electrical equipment. Maximum age limit 35 years. Attractive salary, plus generous allowance in local currency, free passages out and home, free medical attention, kit allowance, good leave arrangements, pension scheme.—Write, giving personal particulars and details of qualifications and experience, quoting Dept. F.191, to Box No. 2593, at 191 Gresham House, E.C.2. (E 415)

ELECTRICAL ENGINEERS are required for the High-voltage Section of the Nelson Research Laboratories of the English Electric Co., Ltd., Stafford. Applicants should possess a degree in electrical engineering and have a sound knowledge and experience of h.v. problems and heavy electrical equipment.—Write, giving full details, quoting reference 229A, to Central Personnel Services, English Electric Co., Ltd., 24-30 Gillingham Street, London S.W.1. (F 275)

CHARGE ENGINEERS

POWER STATION CHARGE ENGINEERS urgently required by major oil company for service in the Middle East. Must hold at least Higher National Certificate in Electrical Engineering and have had not less than three years' experience in the operation of large modern steam power stations with thorough knowledge of the routine operation of water-tube boilers, turbo-alternators, E.H.T. switchgear and auxiliary plant. Present position in this country should be not less than Grade 8a, Class "H" or Grade 8, Class "G" on N.J.B. Scale. Age not over 35 years. Married accommodation available. Commencing salary not less than £900 per annum, plus generous allowance in local currency. Free passages out and home; free medical attention, kit allowance, good leave arrangements. Pension scheme.

Write, giving age, personal particulars, and full details of qualifications and experience, quoting Dept. F.169 to

Box 2550, at 191 Gresham House, E.C.2. (E 284p)

DRAUGHTSMEN, Senior and Junior, with knowledge of high-voltage transmission systems or design and detailing of small switch and fuse gear. Workshop training desirable. Permanent position, with superannuation scheme. Salary according to age and qualifications.—Apply in writing to the Staff Officer, B.I.C.C., Ltd., Prescot, Lancs. (F 229)

ELECTRICAL DESIGNER required (S.E. Scotland), thoroughly experienced in design all types of large and small d.c. machines. Applicants should possess university degree in electrical engineering, or equivalent, and have good electrical engineering qualifications, preferably with drawing office and/or test experience.—State age, qualifications, experience and salary required to: Box No. 1441, Electrical Times. (F 212)

ENGINEERS FOR LIGHTING DEVELOPMENT. Engineers between 25 and 35 years of age with a sound technical education and degree or other qualifications admitting to Corporate Membership of the I.E.E. required for lighting development. Applicants should state age, experience and salary required and must be prepared to accept appointment in either Manchester or Newcastle after an initial period in London. Please reply to: The Lighting Service Bureau, 2 Savoy Hill, London W.C.2. (F 310)

EWBANK & PARTNERS have vacancies for the following:—

DRAUGHTSMAN

(a) MECHANICAL ENGINEERING DRAUGHTSMAN, with experience in power station design and layout.

ENGINEERS

(b) INSTRUMENT ENGINEER, to deal with general instrumentation problems in connection with large power and services problems.

Works experience with a firm of instrument manufacturers is essential, and the duties will involve not only specifying and layout of large instrumentation schemes, but also the commissioning of plant. The duties may involve short visits to home and overseas plants during the commissioning periods.

(c) ENGINEERS FOR INVESTIGATION, TESTING AND COMMISSIONING DEPARTMENT.

Applicants should have a good academic technical qualification and experience in the operation of large power plants. Experience in the development of Heat Balance calculations and diagrams is also required. The duties may involve short visits to home and overseas plants during the plant commissioning period.

(d) ASSISTANT MECHANICAL ENGINEERS, for Contract Department.

Applicants should have had good works experience and technical training up to Higher National Certificate standard. Experience in the design and operation of large power plants an advantage.

(e) JUNIOR TRAINEE ENGINEER for the Investigation, Testing and Commissioning Department.

Applicants should have had a good technical training up to Higher National Certificate Standard and some works experience, preferably in power stations. Duties will involve the keeping of records of the department and calculations dealing with general engineering design.

(f) ELECTRICAL ENGINEER as Assistant to Site Agent on supervision of new construction projects at site.

ENGINEERING CLERK

(g) ENGINEERING CLERK for the Contracts Department.

Previous experience in keeping engineering records essential. Preference given to applicants who have had experience in connection with large power projects involving steam, diesel and hydro plants.

The positions advertised are permanent, offer good prospects and are pensionable.

All applications should be made in writing, addressed to: The Secretary, Ewbank & Partners, 15 Grosvenor Place, S.W.1, and must state position applied for, age and experience of applicant, and salary required. (F 241)

EXPERIENCED ENGINEERS accustomed to the erection of overhead lines using wood, concrete, or lattice construction, and willing to serve either at home or overseas, age 25-45.—Applications in writing to the Staff Officer, British Insulated Callender's Construction Co. Ltd., 21 Bloomsbury Street, London W.C.1. (F 309)

INSIDE ASSISTANT required for London Sales Office. Switchgear knowledge essential and previous experience in correspondence and tendering desirable.—George Ellison Ltd., 131 Victoria Street, S.W.1. (F 308)

INTERESTING and progressive position exists for ELECTRICAL DESIGN DRAUGHTSMAN in rapidly expanding company. Experience on light, relay and electro-magnetic components would be an advantage.—Apply to Mr. G. T. Atkins, Electrical Engineer, British Messier, Ltd., Cheltenham Road East, Gloucester. (F 285)

J. H. TUCKER AND CO., LTD., require a DISTRICT SALES REPRESENTATIVE for Yorkshire and North Eastern England. Age under 40. Progressive position for man having sound connection and knowledge of electrical accessories.—Apply, in confidence, giving full particulars of experience and remuneration required to the Sales Manager, Kings Road, Tyseley, Birmingham 11. (F 305)

JUNIOR DRAUGHTSMAN required. Excellent opportunity for gaining first-class experience in an important branch of the electrical industry. West London area A.E.S.D. London rate.—Write full details of experience to: Box No. 1447, Electrical Times. (F 215)

LARGE manufacturing firm in S.E. Scotland requires TWO ELECTRICAL DESIGNERS, thoroughly experienced all types of induction motors up to 250 b.h.p. Applicants should possess university degree in electrical engineering, or equivalent, and have good practical training, preferably with drawing office and/or test experience.—State age, qualifications, experience, and salary required to: Box No. 1443, Electrical Times. (F 213)

PLANNING AND METHODS ENGINEER required. Age 22-25. Preferably with experience of small electro-mechanical parts.—Write, full particulars and salary required to: Box No. 1449, Electrical Times. (F 216)

REPRESENTATIVES with experience required for Temco Wiring Accessories and Synchronous Electric Clocks in those areas covered by Yorkshire, Merseyside and N. Wales, also N. Western Boards. Salary, commission, expenses; car provided.—Replies, stating age, experience and remuneration required, in strict confidence to T. M. C. Harwell (Sales) Ltd., 37 Upper Berkeley St., London W.1. (F 264)

SALES REPRESENTATIVES required in all areas for marketing an entirely new 5-amp switch of revolutionary design and phenomenal performance. Previous experience and sound established connections essential, particularly with Electricity Authorities, large contractors and Municipal Authorities. Good salary and commission plus car allowance. Write, stating age, experience, etc., and area thoroughly covered. Replies treated in strictest confidence.—Managing Director, Box No. 1469, Electrical Times. (F 287)

SANGAMO WESTON, LTD., have a vacancy in their INSTRUMENT SALES CORRESPONDENCE SECTION. Applicants should have a good general technical training, with some specialisation in electrical measuring apparatus. They should be capable of expressing themselves clearly and concisely both in conversation and correspondence.—Applications should be sent in strict confidence to the Employment Manager, Sangamo Weston, Ltd., Cambridge Road, Enfield, Middlesex. (F 200)

SENIOR DRAUGHTSMEN/DESIGNERS with sound basic training and experience in either (1) structural, design, steel, or R.C.; (2) electrical plant layout, e.h.t. switchgear, and cabling; (3) railways, bridges, and sidings. London office, pension fund, salary according to experience. State age and salary requirement and Ref. 22/6.—Write, Box 843, c/o Walter Judd, Ltd., 47 Gresham Street, E.C.2. (F 268)

TIME STUDY ENGINEERS required for a large light engineering organisation in the Ealing area. Applicants should have had an engineering apprenticeship and at least five years' experience in Speed and Effort Rating on every element. Some Motion Study is involved.—Applications, giving full details of age, qualifications and experience, to the Employment Officer, Hoover Limited, Perivale, Greenford, Middx. (F 302)

CHIEF DRAUGHTSMAN required by well-established switchgear manufacturers transferring their works to South Devon. He would be required to take charge of 4/5 draughtsmen engaged on Medium Voltage Metalclad Switchgear Contracts, and must have a good working knowledge of H.R.C. Fused Switchgear and Oil Circuit Breakers. Required at N.W. London Works for approximately 4 months before transfer. Only first-class men need apply. Good salary and excellent prospects to the right man.

Reply to Box No. 1395, Electrical Times.

(F 102p)

TRANSFORMER INSIDE SALES ENGINEER required thoroughly experienced in estimating and tendering for all types of transformers, large and small, for the home and export markets.—Applications, stating age, practical, technical and commercial experience, and salary required to: Manager, T/M Departments, Bruce Peebles and Co. Ltd., Edinburgh. (F 211)

WIREMAN ELECTRICIAN wanted to work with owner of small jobbing business near Baker Street Station, who is approaching retiring age; main object view to becoming partner and eventually taking over. Must be prepared for hard work and responsibility. Pay rate, plus bonus of not less than £50 per year to right man.—Write, in first place, to Box No. 1435, Electrical Times, giving full particulars of experience, age, etc., and references. (F 204)

APPOINTMENTS WANTED

B.E.A. DEMONSTRATOR (20), holding E.A.W. certificate, with experience domestic appliances, seeks transfer to southern area.—Box No. 1463, Electrical Times. (F 266)

B.E.A. STORES OFFICER (30), experienced storekeeper, stock control, purchasing and selling, seeks position in a private concern. Willing to accept anything with future prospects.—Box No. 1423, Electrical Times. (F 188)

WORK WANTED

A.C. and d.c. Motor Rewinds and Repairs. Prompt service fully guaranteed.—Edgware 8631 (4 lines). Service Electric Co., Ltd., Stanmore, Middx. (D 324)

ARMATURE ROTOR AND STATOR WINDING. We specialise in the repair and rewind of all types of electrical machines from fractional h.p. upwards. Special departments for vacuum cleaners, dryers, portable tools, etc. All work fully guaranteed.—Walter Crane, Greencoat Electrical Works, Westgate, Wakefield. Telephone 2172. (A 4)

CASTINGS, Fisher Foundries, Ltd., Greet, Birmingham, have capacity for brass, gun metal and soft grey iron machine moulded repetition castings weighing 1-30 lb. Loose pattern work up to 3 cwt. Delivery by road to all parts. Tel.: B'ham, Victoria 0197. (F 270)

ZEROS REFRIGERATORS.—Complete range of repair and service now available. Equipment reconditioned to conform to pre-war manufacturers' specifications.—Time Engineers, Refrigeration Specialists, 60 Southend Road, Rainham, Essex. Tel.: Rainham 2358; or Southern Area Agency. Tel.: Springpark 4217. Electrical Spares supplied to the trade. (A 639)

WANTED

A.C.D.C. MOTORS, STARTERS, complete change-over installations, etc.—A.A. Electrical Co., Ltd., 67 Rothschild Road, Chiswick Park, W.4. Phone: Chiswick 5105. (A 20)

SCRAP ACCUMULATOR PLATES and Sediment wanted, any quantities. Also Storage Batteries purchased and dismantled.—Phone or write Elton Levy & Co., Ltd., St. Ermin's (West Side), Caxton Street, London S.W. Phone: WHitehall 9621/2/3. (A 3)

WANTED.—D.C. and a.c. ball-bearing MOTORS.—Full details to Britannia Manufacturing Co., Ltd., 22/26 Britannia Walk, London N.1. (A 13)

WANTED. ROTARY CONVERTERS, any size.—Universal, 221 City Road, London E.C.1. (A 16)

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper, Ltd., 176 Brady St., Bethnal Green E.1. (A 1)

WANTED.—Large quantity of 4-in. outside diameter TUBES from the dismantling of old Babcock Water-tube Boilers. Best prices paid. Prepared to purchase Babcock and Wilcox Water-tube Boilers for dismantling. —Apply, giving full details to Midland Iron and Hardware Co., Cradley Heath. (A 5)

WANTED FOR CASH, CLEARING LINES Fire-bars, Boiling Ring Plates, Pencil Elements (all sizes), with or without spirals; Nickel Chrome Wire and Spirals. —Send offers with full particulars, Adalco, 90 Church Road, London N.W.10. (F 283)

WANTED, 2½ kVA Briggs & Stratton, or similar, 110/120 V. 60 c/s GENERATOR. Must be little used, complete, and excellent condition. Unused Government surplus preferred. Low price for resale.—Higham, 105 Leyland Road, Penwortham, Preston. (F 304)

BUSINESS OPPORTUNITIES

AGENTS (outside Lancashire) required to sell a branded range of mica iron, kettle, and toaster elements to the bona fide electrical wholesale trade. Commission basis. State territory, experience, and agencies carried. —Box No. 1465, Electrical Times. (F 281)

INTEREST offered in established ELECTRICAL CONTRACTING BUSINESS to person capable of taking charge of business side. Capital required £500/£1,000. Coast town.—Box No. 1437, Electrical Times. (F 205)

AGENCIES

TECHNICAL REPRESENTATIVE requires agencies for all types electrical goods including switchgear, accessories, cables, conduits, etc., covering Kent and S.E. Coast. Commission or salary.—Box No. 1433, Electrical Times. (F 199)

FOR SALE

CABLES & WIRE

FOR immediate disposal, 400 rolls DOUBLE ASBESTOS COVERED COPPER WIRE, 100 yds x 16 s.w.g., 25/- per roll; perfect. Large quantity 6 BA x 7/8 Brass Round Head Screws, 9d. gross. Large quantity Black Insulation Tape, ¾in., 7½d. per ½lb. roll. Samples on request.—Wyllan Equipment Co., 37-39 Houldsworth St., Manchester 1. CENtral 7734. (F 303)

PAPER INSULATED ARMOURED CABLES to BSS 480/1942. Considerable stocks available.—Cable Jointers, Ltd., 49 Avenue Road, W.3. Acorn 4831/2. (E 489)

TOUGH RUBBER CABLE available, all sizes and types: non-standard lengths (25 yd. to 50 yd.). Special prices quoted for regular buyer. Must be a user. Guaranteed strictly to B.S.S.7.—Box No. 1363, Electrical Times. (F 39)

UNUSED Glowray Resistance Wire, 17 and 13 s.w.g., 0·6566 ohm and 0·2468 ohm per yard, 14 and 28-lb reels, 3/- per lb.—Particulars and samples, Burden, 70a Hamilton Road, Salisbury. (F 271)

DOMESTIC APPLIANCES

ALL types of IMMERSION HEATERS repaired; new reliable TUBULAR TYPE ELEMENTS fitted.—R. Hamilton & Co. Ltd., 27 Turner Street, Manchester 4. Tel.: Blackfriars 1744. (F 312)

ELECTRIC HOP CUPBOARD with heated top plate 6 ft by 3 ft interior capacity, approx. 16 cu ft. Loading 3 kW, 230 V. Suit canteen or restaurant.—S. F. Durrant, 27 Elmhurst Drive, Ipswich. (F 301)

G.B.M. IMMERSION HEATERS, all lengths 12 in. to 42 in., 2 kW and 3 kW, standard voltages. Also 4 kW (non-taxable), all sizes. Satchwell thermostatic control. Guaranteed two years. Immediate delivery. For illustrated brochure and trade terms write direct to manufacturers.—G.B.M. (Electrical) Birmingham Ltd., 439 Moseley Rd., Birmingham 12. Phone: Calthorpe 2654. (F 178)

IMMERSION HEATERS. Grubb 2 kW and 3kW standard voltages, all lengths, 12 in. to 36 in. Also 4kW (non-taxable). 16 in. to 36 in. Fully guaranteed and immediate delivery. For illustrated brochure, latest lists and trade terms write distributors, John Owner and Co., Springfield Road, Birmingham 13. Tel.: Spr. 2939. (C 392)

ENGINEERING PLANT & MATERIALS

ALUMINIUM ALLOY. Special offer: 6ft. x 3ft x 24 gauge flat or corrugated sheets, £9 9s. per dozen. Also angles available. All prices, carriage paid. Delivery ex-stock.—Sawyers Manufacturing Co., Ltd., Bures, Suffolk Tel.: Bures 351/2. (B 335)

LADDERS (wooden and aluminium, all types), Trestles, Steps, Handcarts, etc., from Ramsay and Sons (Forfar) Ltd., Forfar (Tel. 172). (C 603)

POWER PLANT bought and sold. Boilers, Diesel Engines, Generating Sets, etc.—W. H. Collingbourne, A.M.I.Mech.E., 1481 Stratford Road, Birmingham 28. Tel.: Shirley 3303. (F 145)

GENERATING PLANT

ALTERNATORS from stock, 400/440 V, 3-phase, 50 c/s, with Exciters and switchboards. 80 kVA "GEC" 1,000 r.p.m. 40 kW "ECC." 750 r.p.m. 28 kVA "Crompark," 1,500 r.p.m.—Full details, write: Thos. W. Ward Ltd., Albion Works, Sheffield. Phone 26311 (ex 347). (E 109)

DIESEL ALTERNATOR Sets from stock up to 100 kVA, 1 and 3 phase, standard voltage, details post free on request.—Thos. W. Ward Ltd., Albion Works, Sheffield. Phone 26311 (ex 347). (E 108)

DIESEL-DRIVEN GENERATING SETS. Two unused 375-kVA (300-kW) diesel alternator sets. Engine by Buckeye Machine Co., model 80, 480 h.p. at 600 r.p.m., direct coupled to 375-kVA alternator by Elliott, U.S.A., 400/230/3/50, 542/940 amp, 0·8 p.f. Enclosed ventilated type, revolving field. Exciter mounted on alternator. Complete with air starting compressor and control gear.

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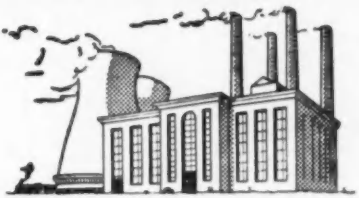

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INDEX TO ADVERTISERS

A.E.W. Ltd. 54
Alton Battery Co., Ltd. ... 7
Aluminium Wire and Cable Co., Ltd. 3
Ashdowns Ltd. 50
Attwater and Sons 58
Automatic Coil Winder and Electrical Equipment Co., Ltd. 31
Automatic Light Controlling Co., Ltd. 70
Automatic Telephone and Electric Co., Ltd. 26

B. and H. (Nottingham), Ltd. ... 66
Baker Metal Stopper Co., Ltd. ... 4
Belling and Co., Ltd. 6
Belmos Co., Ltd. 8
Berry's Electric Ltd. 14
Britannia Batteries, Ltd. 16
British Electrical Repairs Ltd. ... 35
British Electricity Authority ... 36
British Insulated Callender's Cables, Ltd. 19
British Thomson-Houston Co., Ltd. 32, 74
Brook Motors, Ltd. 53
Brush Electrical Engineering Co., Ltd. 37
Burco, Ltd. 57

Cable Makers Association ... 27
Chase Products (Neon), Ltd. ... 54
Chloride Batteries, Ltd. 13
Clifford, Charles, and Son Ltd. 49
Cressall Manufacturing Co., Ltd. 4
Crompton Parkinson, Ltd. ... 65

D.P. Battery Co., Ltd. 70
Downes and Davies, Ltd. ... 52

Eagle Engineering Co., Ltd. ... 18
East London Mica Works ... 70
Edwards, F. J., Ltd. 70
Elexcel, Ltd. 30
English Electric Co., Ltd. ... 33
Essex Partners, Ltd. 66
Evershed and Vignoles, Ltd. ... 12

Ferranti, Ltd. 5
Fluxite, Ltd. 68
Foster Transformers and Switchgear, Ltd. 23
French, W. T. and Sons, Ltd. ... 67

General Electric Co., Ltd. 1, 38, 40
Grubb Engineering Co., Ltd. ... 58

Harboro' Rubber Co., Ltd. ... 56
Hardy and Padmore, Ltd. ... 62
Hart Accumulator Co., Ltd. ... 54
Hartley Electromotives Ltd. ... 60
Henley's W.T. Tele. Works Co., Ltd. 41
Higgs Motors, Ltd. 10

Imperial Chemical Industries Ltd. 63
Imperial Life Assurance Company of Canada 60
Inductive Appliances Ltd. ... 4
Isenthal & Co. Ltd. 22

Johnson and Phillips, Ltd. 29, 69

Londex, Ltd. 68
London Electric Wire Co. and Smiths, Ltd. 59
Low, Duncan, Ltd. 22
Lundberg, A. P. and Sons, Ltd. ... 11

McKechnie Bros., Ltd. 60
Metafiltration Co., Ltd. 56
Metropolitan-Vickers Electrical Co. Ltd. 17
Metway Electrical Industries, Ltd. 28
Midland Electric Manufacturing Co., Ltd. 51

Nalder Bros. and Thompson, Ltd. 21
Nettle Accessories Ltd. 18
Newton Bros. (Derby), Ltd. ... 62

Oldfield Engineering Co., Ltd. ... 64

Parmiter, Hope and Sugden Ltd. ... 73
Partridge, Jones and John Paton Ltd. 55
Petrochemicals, Ltd. 15

Record Electrical Co., Ltd. ... 25
Resinoid and Mica Products Ltd. 66
Reyrolle, A. and Co., Ltd. ... 71
Rozalex, Ltd. 56
Runbaken, Ltd. 70

Sangamo Weston, Ltd. 42
Santon, Ltd. 61
Saxonia Electrical Wire Co., Ltd. 68
Scott, H. J. and Co. (Belfast), Ltd. 28
Scottish Cables, Ltd. 72
Siemens Bros. and Co., Ltd. ... 24
Simplex Electric Co., Ltd. ... 2
Standard Telephones and Cables Ltd. 34

Thorpe, F. W., Ltd. 64

Wakefield, C. C. and Co., Ltd. ... 9
Walter, D. and Co., Ltd. ... 58
Wandleside Cable Works, Ltd. ... 64
Westinghouse Brake and Signal Co., Ltd. 20
Wireohms, Ltd. 66
Wootton and Co., Ltd. 68

Yarrow and Co., Ltd. 52

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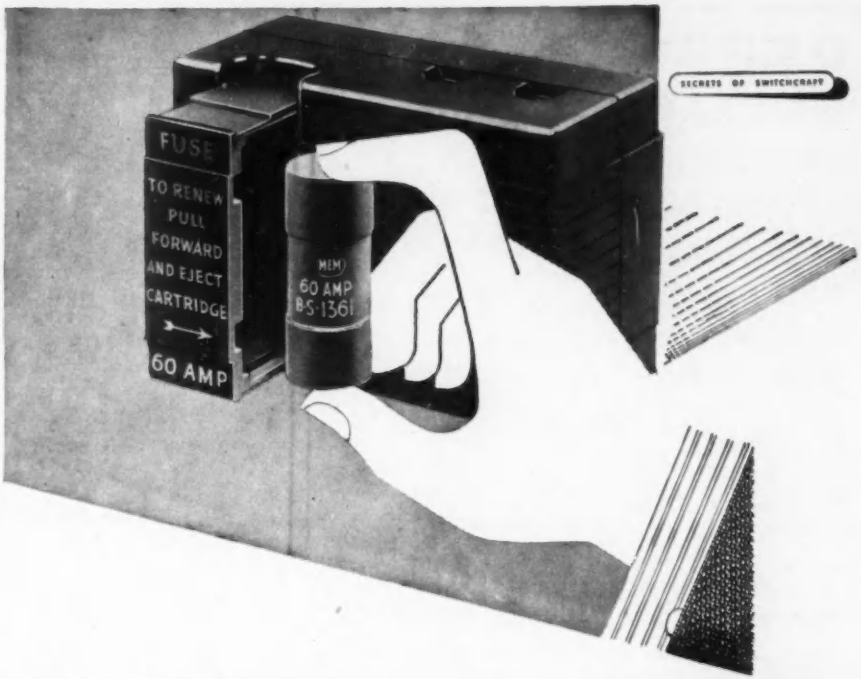

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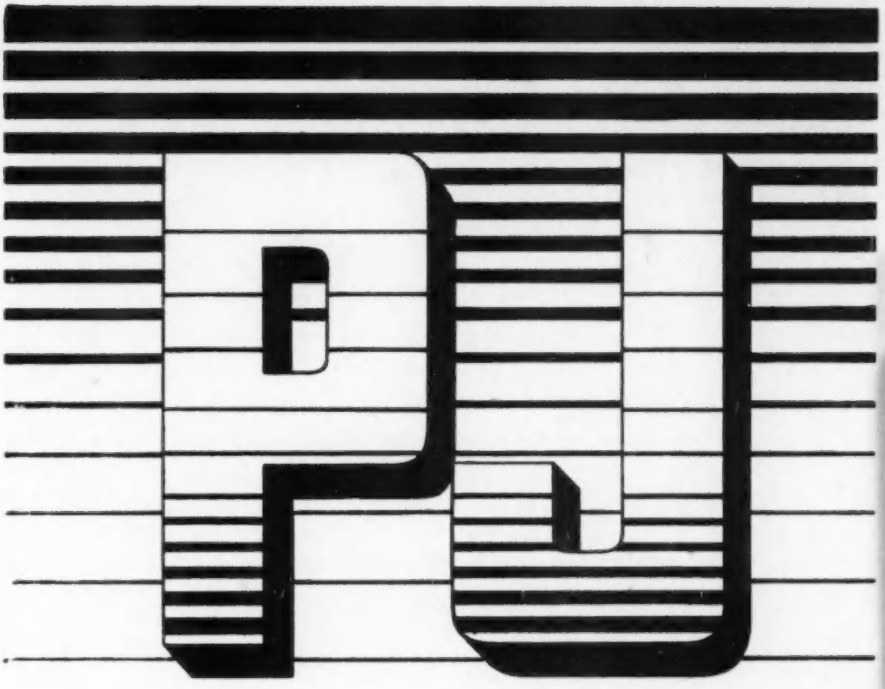

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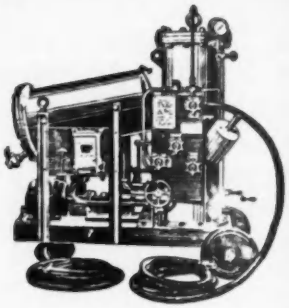

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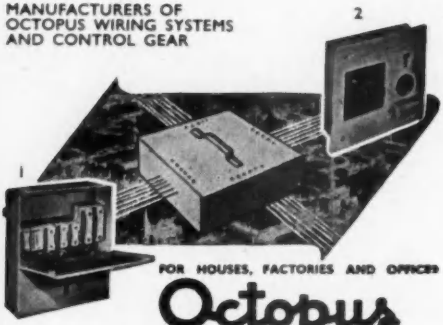

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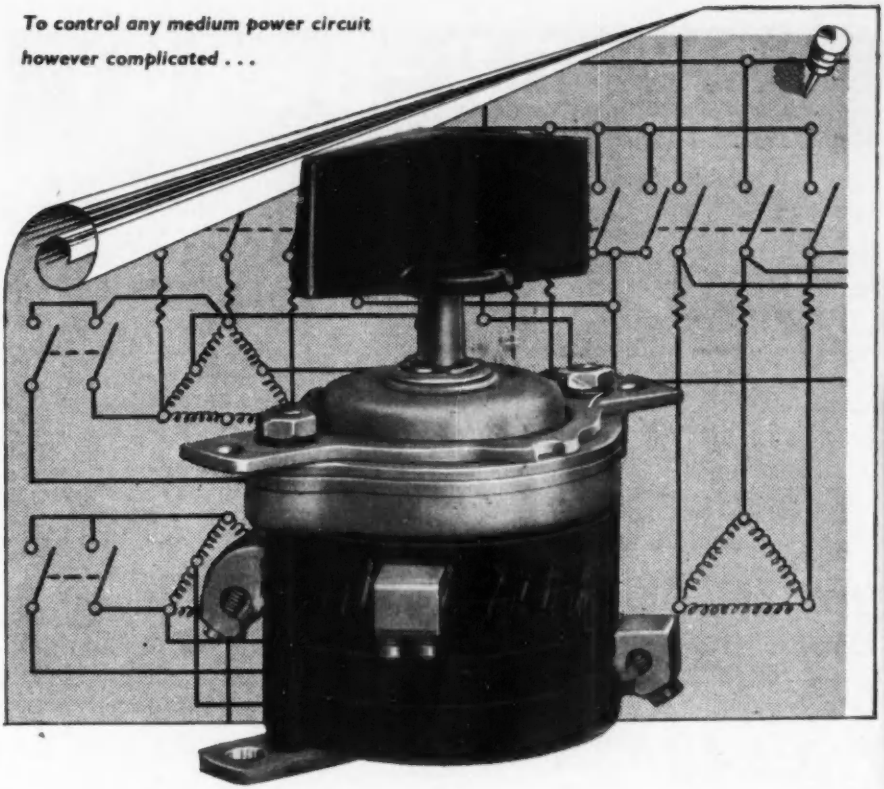

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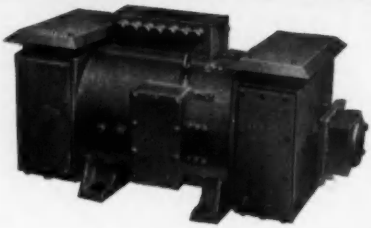

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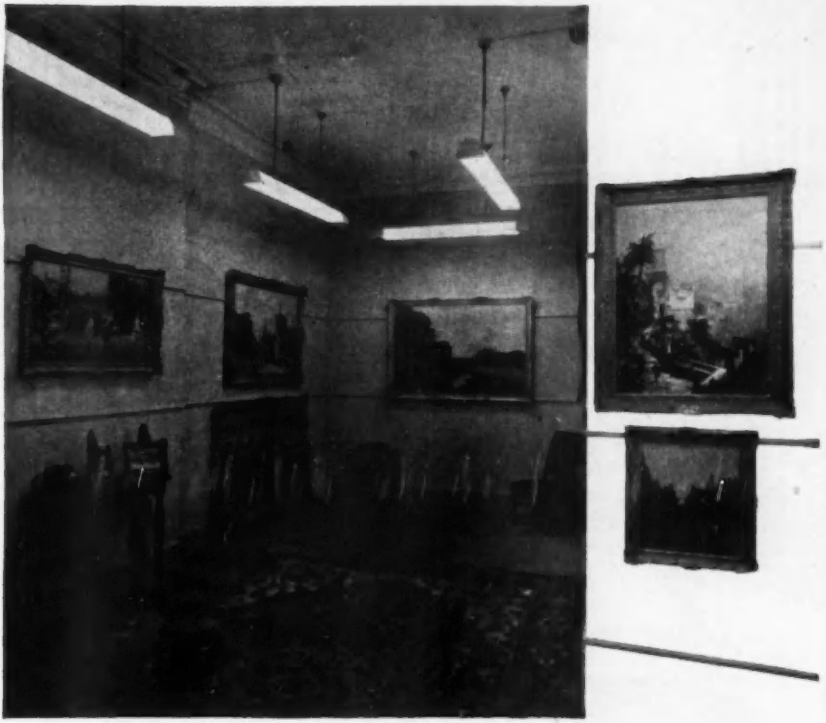

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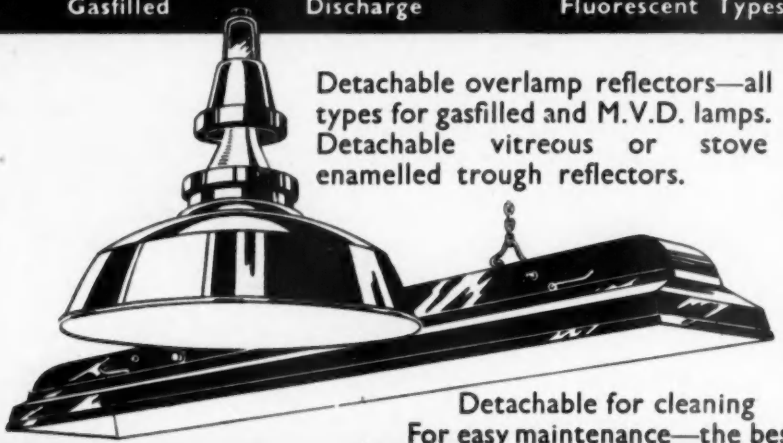

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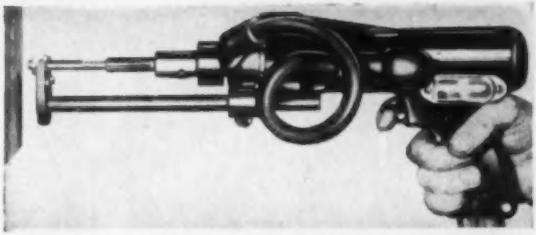

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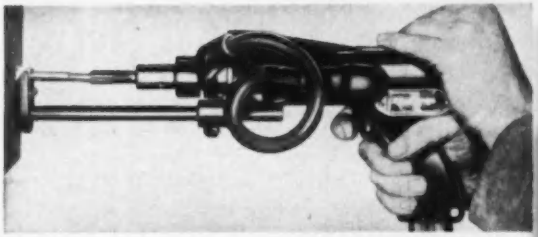

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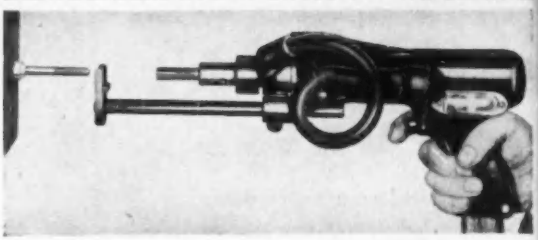

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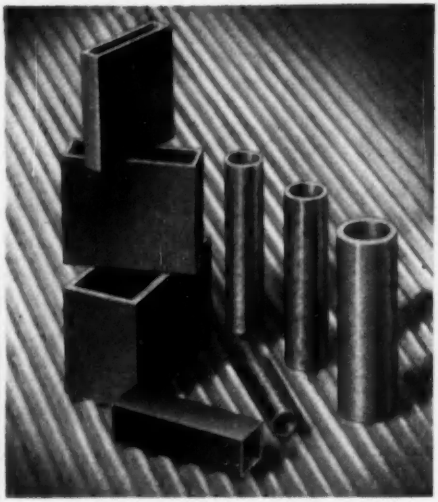

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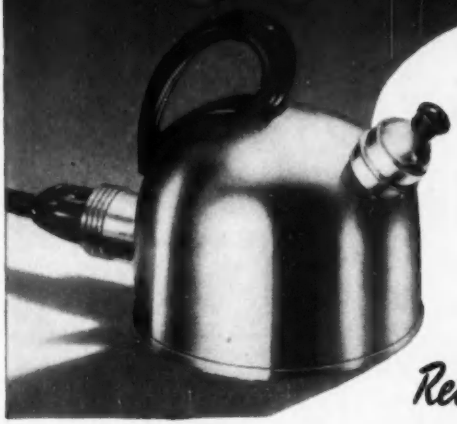

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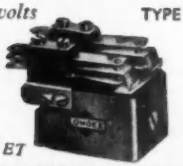

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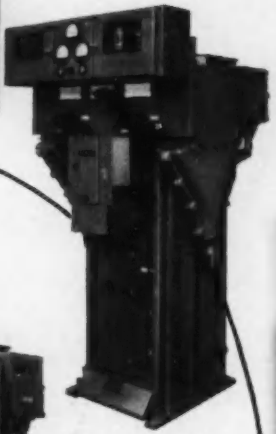

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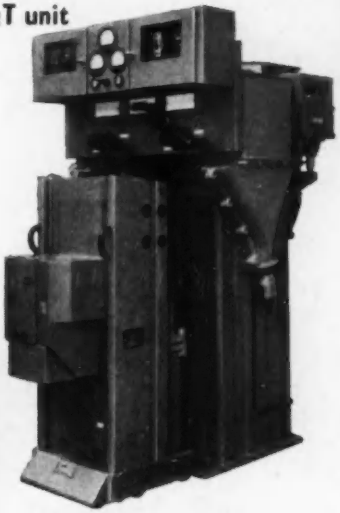

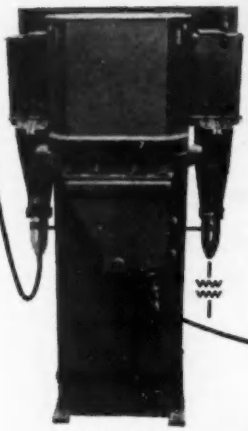

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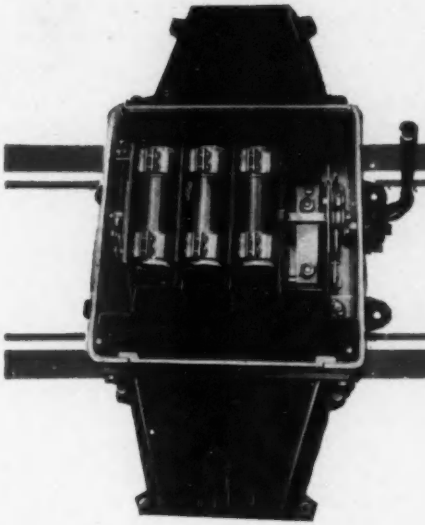

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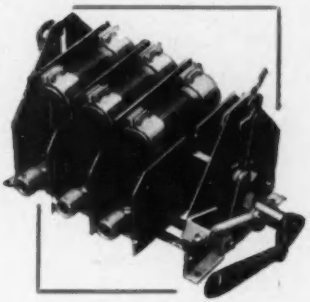

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